AD-A226 942

DTIC ACCESSION NUMBER

PHOTOGRAPH THIS SHEET

DTIC FILE COPY

LEVEL

1

INVENTORY

IRP PHASE I AF PLANTS NOS 28 + 29

JUNE 1984

DOCUMENT IDENTIFICATION

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR

NTIS GRA&I X

DTIC TRAC ☐

UNANNOUNCED ☐

JUSTIFICATION

BY

DISTRIBUTION/

AVAILABILITY CODES

DISTRIBUTION	AVAILABILITY AND/OR SPECIAL	
A-1		

DISTRIBUTION STAMP

DTIC COPY INSPECTED 4

DTIC ELECTE OCT 01 1990 D

E

DATE ACCESSIONED

STATEMENT "A" per Mr.Poulis
HQ Air Force Engineering and Services
Center/TIC Bldg. 1120/Stop 21
Tyndall AFB, FL 32403-6001
TELECON 9/19/90 JC

DATE RETURNED

90 09 18 010

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NUMBER

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-FDAC

DTIC FORM APR 87 70A

DOCUMENT PROCESSING SHEET

PREVIOUS EDITIONS MAY BE USED UNTIL STOCK IS EXHAUSTED

AD-A226 942

INSTALLATION RESTORATION PROGRAM

PHASE I - RECORDS SEARCH

AIR FORCE PLANTS NOS. 28 AND 29
EVERETT AND LYNN, MA

PREPARED FOR

UNITED STATES AIR FORCE
HQ AFESC/DEV
Tyndall AFB, Florida
and
HQ ASD/PMD
Wright Patterson AFB, Ohio

JUNE 1984

ES ENGINEERING-SCIENCE

NOTICE

This report has been prepared for the United States Air Force by Engineering-Science for the purpose of aiding in the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

Copies of the report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Technical Information Center should direct requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

INSTALLATION RESTORATION PROGRAM
PHASE I - RECORDS SEARCH

AIR FORCE PLANTS NOS. 28 AND 29
EVERETT AND LYNN, MA

Prepared For

UNITED STATES AIR FORCE
HQ AFESC/DEV
Tyndall AFB, Florida
and
HQ ASD/PMD
Wright Patterson AFB, Ohio

June 1984

Prepared By

ENGINEERING-SCIENCE
57 Executive Park South, Suite 590
Atlanta, Georgia 30329

NOTICE

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for AF Plants (AFP) 28 and 29 under Contract No. F08637-80-G0009.

INSTALLATION DESCRIPTION

AFP No. 28 (General Electric Lynn Manufacturing Department) is located in the City of Everett, Essex County, Massachusetts, about two miles north of Boston. The plant site is situated between the residential community of West Everett on the east and the Malden River on the west. The facility is composed of ten buildings having 344,342 square feet of floor space on a 43-acre tract. The plant is engaged in the manufacture of large jet engine comp~nents and sub-assemblies.

AFP No. 29 (General Electric River Works Facility) is located in the City of Lynn, Middlesex County, Massachusetts, about six miles north of Boston. The plant site is located adjacent to the Saugus River and consists of an eight-acre plot in the southwest corner of the General Electric River Works facility and a fuel tank farm located in the southeast section of the plant. AFP No. 29 is part of the General Electric Aircraft Engine Business Group and the facilities are used for testing and assembly of jet engines.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate that the following major points are relevant to the evaluation of past hazardous waste management practices at Plants 28 and 29.

- o Climatic data indicates a high net precipitation for the study area, suggesting a potential for infiltration and/or contaminant migration. The one-year, 24-hour rainfall value is 2.5 inches; indicating low runoff and erosion potential.
- o Surface materials of both plant sites consists of fill (sand, gravel, construction debris, etc.) which if unpaved, is considered to be permeable. A shallow water table is present in this stratum at both plants.
- o The fill is part of an identified "shallow aquifer" present at both plants (probably acting in concert with marsh and marine sand deposits). The plants are located in recharge zones for this aquifer which likely discharges to local surface waters.
- o A deeper unconsolidated aquifer composed of stratified glacial materials is present at greater depth beneath both plants. Although not utilized by consumers proximate to the plants, this aquifer has the greatest development potential in the study area. Overlying units may recharge this aquifer.
- o A deep bedrock aquifer exists in the study area, but is not exploited in the vicinity of the plants, therefore, little is known of its characteristics.
- o Both plants and nearby communities obtain water resources from municipal water distribution systems.
- o Shallow aquifer contamination has been identified at Plant 29 and is the subject of a continuing remediation program.
- o Flooding is not known to be a problem typcial of the study area.
- o No threatened or endangered species are known to exist in the study area.

From these major points, it may be seen that potential pathways for the migration of waste-related contamination exist. If hazardous

materials are present in or on the ground, they may encounter a shallow aquifer and subsequently be discharged to area surface waters. The potential for further migration is considered to be remote.

METHODOLOGY

During the course of this project, interviews were conducted with plant personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state, and federal agencies; and field and aerial surveys were conducted at suspected past hazardous waste activity sites. Sites located within AFP 28 and 29 boundaries were identified as potentially containing hazardous contaminants and having the potential for migration resulting from past activities (Figures 1 and 2). These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration, and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-on action.

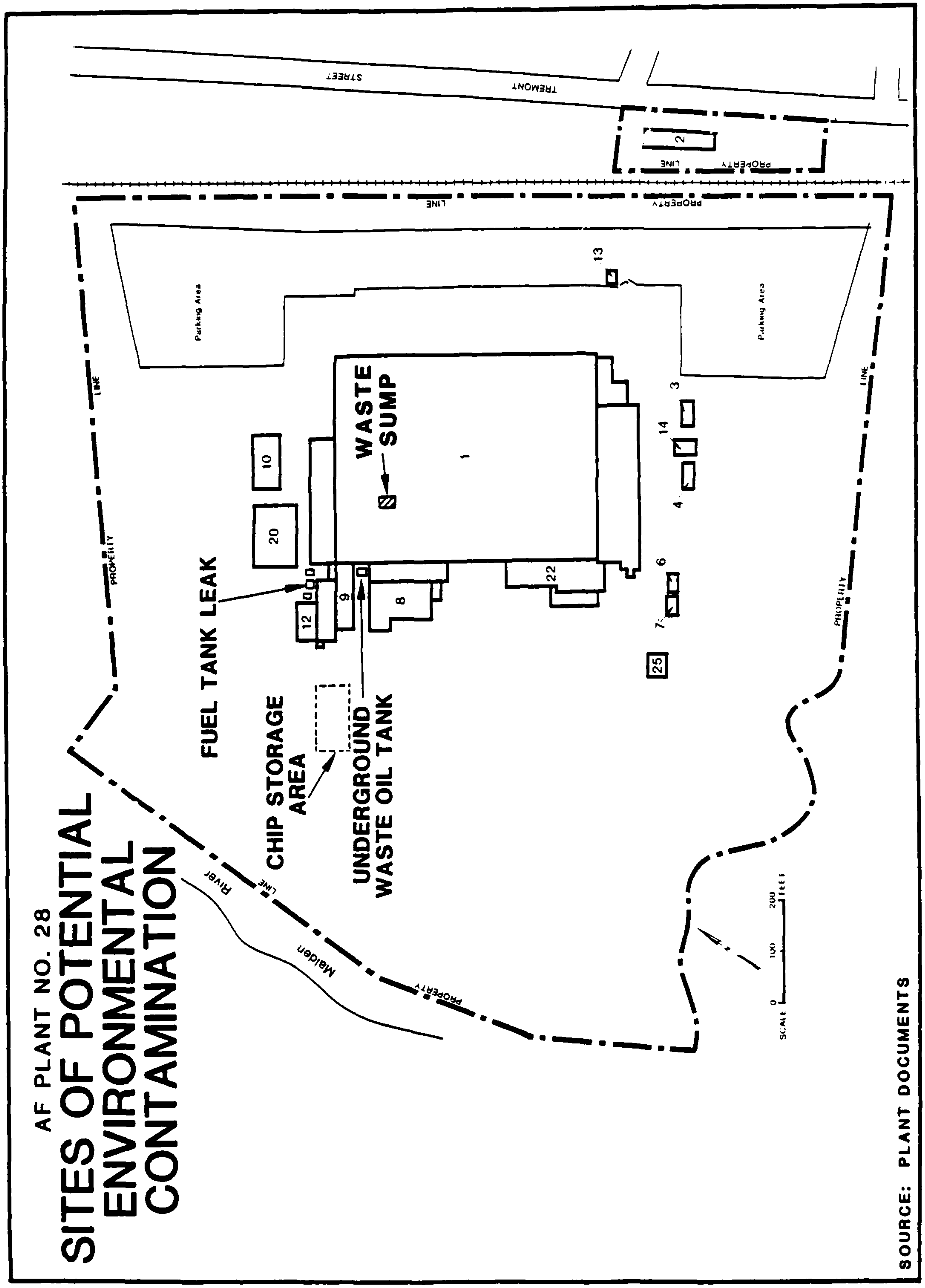
FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team's field inspection, review of plant records and files, and interviews with plant personnel.

Each of the three sites listed below was ranked using the HARM system and was determined to have a sufficient potential for environmental contamination to warrant some degree of follow-on investigation.

AFP No. 28	Waste Sump
AFP No. 28	Chip Storage Area
AFP No. 29	Underground Fuel Line Leaks
AFP No. 29	Underground Fuel Storage Tank Leak

FIGURE 1

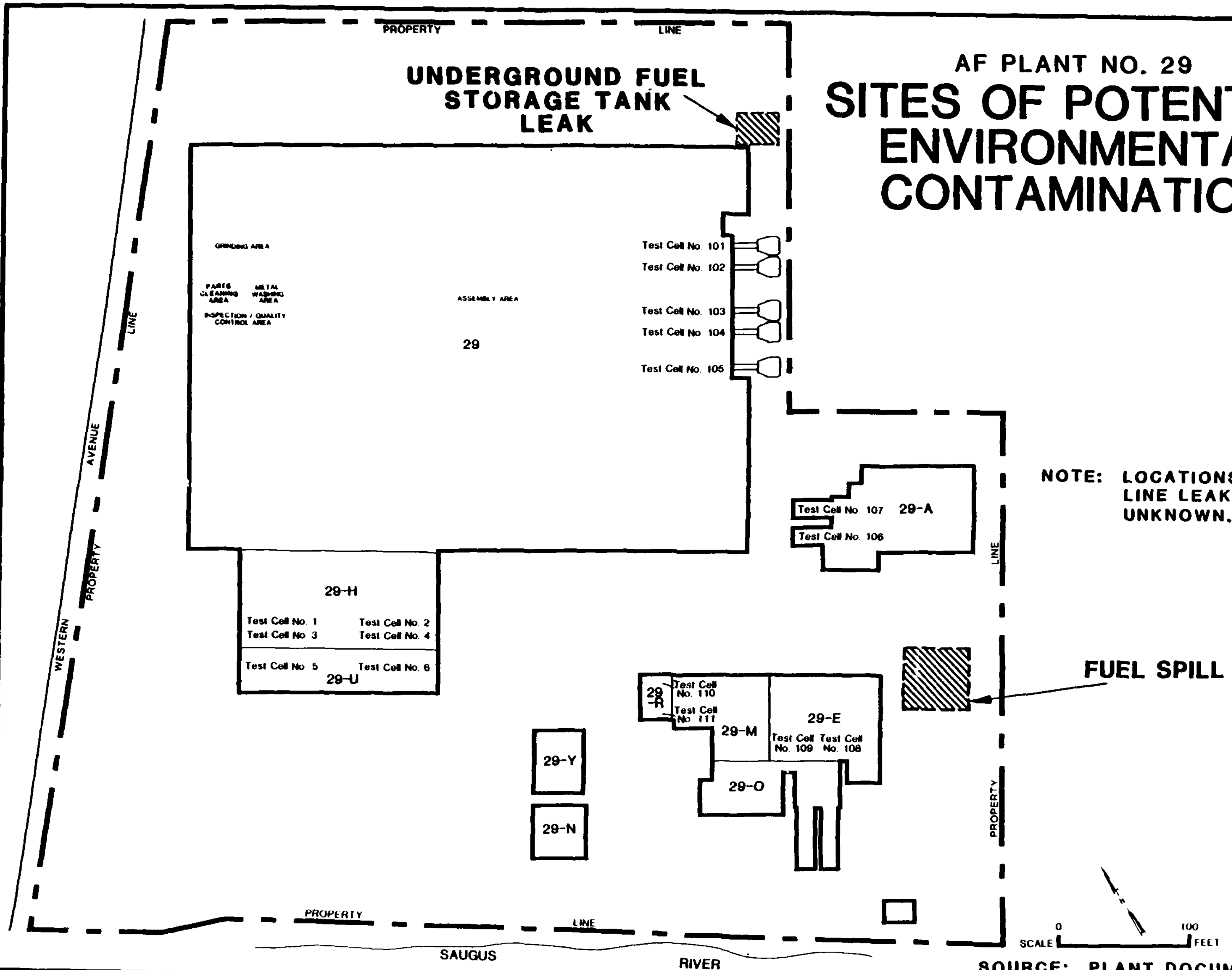


AF PLANT NO. 28
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION

SOURCE: PLANT DOCUMENTS

FIGURE 2

AF PLANT NO. 29
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION



NOTE: LOCATIONS OF FUEL LINE LEAKS ARE UNKNOWN.

SOURCE: PLANT DOCUMENTS

TABLE 1
SITES EVALUATED USING THE HAZARDOUS ASSESSMENT
RATING METHODOLOGY
AIR FORCE PLANTS NOS. 28 AND 29

Rank	Site	Operating Period	Final HARM Score
AFP No. 28			
1	Waste Sump	1941 - 1979	50
2	Chip Storage Area (010)	1941 - 1973	50
3	Underground Tank Leak	1941 - 1979	49
4	Underground Waste Oil Tank Leak	1941 - 1980	49
AFP No. 29			
1	Underground Fuel Line Leaks	1943 - 1970's	53
2	Underground Fuel Storage Tank Leak	1943 - 1978	51
3	Fuel Spill	1983	5

The following sites were evaluated and were determined to have insufficient potential for environmental contamination and no follow-on investigation is warranted:

AFP No. 28	Underground Tank Leak
AFP No. 28	Underground Waste Oil Tank Leak
AFP No. 29	Fuel Spill

RECOMMENDATIONS

A program for proceeding with Phase II of the IRP at Plants 28 and 29 is presented in Section 6 of this report. The Phase II recommendations are summarized as follows:

- AFP No. 28 — Waste Sump - install monitoring wells at four locations. Collect and analyze ground-water samples.

  Chip Storage Area - conduct soil sampling at four locations and install a monitoring well. Collect and analyze soil and ground-water samples.
- AFP No. 29 — Underground Fuel Line and Fuel Storage Tank Leaks (to be monitored as a single contaminant source) - install monitoring wells at five locations. Collect and analyze ground-water samples.

SECTION 1

INTRODUCTION

BACKGROUND

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP will be the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and clarified by Executive Order 12316. CERCLA is the primary federal legislation governing remedial action at past hazardous waste disposal sites.

PURPOSE AND SCOPE OF THE ASSESSMENT

The Installation Restoration Program has been developed as a four-phased program as follows:

Phase I	- Initial Assessment/Records Search
Phase II	- Confirmation and Quantification
Phase III	- Technology Base Development
Phase IV	- Operations/Remedial Actions

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Air Force Plants Nos. 28 and 29 under Contract No. F08637-83-R0060. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommendations for follow-on actions.

The goal of the first phase of the program was to identify the potential for environmental contamination from past waste disposal practices at Air Force Plants Nos. 28 and 29, and to assess the potential for contaminant migration. The activities that were performed in the Phase I study included the following:

- Review of site records
- Interview of personnel familiar with past generation and disposal activities
- Survey of types and quantities of waste generated
- Determination of estimated quantities and locations of current and past hazardous waste treatment, storage, and disposal
- Definition of the environmental setting at the plant
- Review of past disposal practices and methods
- Field tour of plant facilities
- Collection of pertinent information from Federal, state, and local agencies
- Assessment of potential for contaminant migration
- Development of follow-on recommendations.

ES performed the on-site portion of the records search during March 1983. The following team of professionals were involved:

- E. J. Schroeder, Environmental Engineer and Project Manager, MSCE, 17 years of professional experience
- J. R. Absalon, Hydrogeologist, 11 years of professional experience
- S. R. Steele, Environmental Scientist, 6 years of professional experience

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Air Force Plants Nos. 28 and 29 Records Search began with a review of past and present industrial operations conducted at the plants. Information was obtained from available records and files, as well as interviews with past and present plant employees from the various operating areas. Those interviewed included 32 current and past personnel associated with Air Force Plants Nos. 28 and 29. A listing of the plant interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the plant interviews, the applicable Federal, state, and local agencies were contacted for pertinent plant-related environmental data. The agencies contacted and interviewed are listed below and additional information is included in Appendix B.

- U.S. Environmental Protection Agency (EPA), Region I, Boston, MA
- U.S. Geological Survey (USGS), Water Resources Division, Boston, MA
- U.S. Department of Agriculture, Soil Conservation Department, Littleton, MA
- U.S. Department of Commerce, National Climatic Data Center, Asheville, NC
- Geological Society of America, Boulder, CO

- Metropolitan Boston, Northeast Region, Department of Environmental Quality Engineering, Woburn, MA
- Division of Water Pollution Control, Department of Environmental Quality Engineering, Westboro, MA

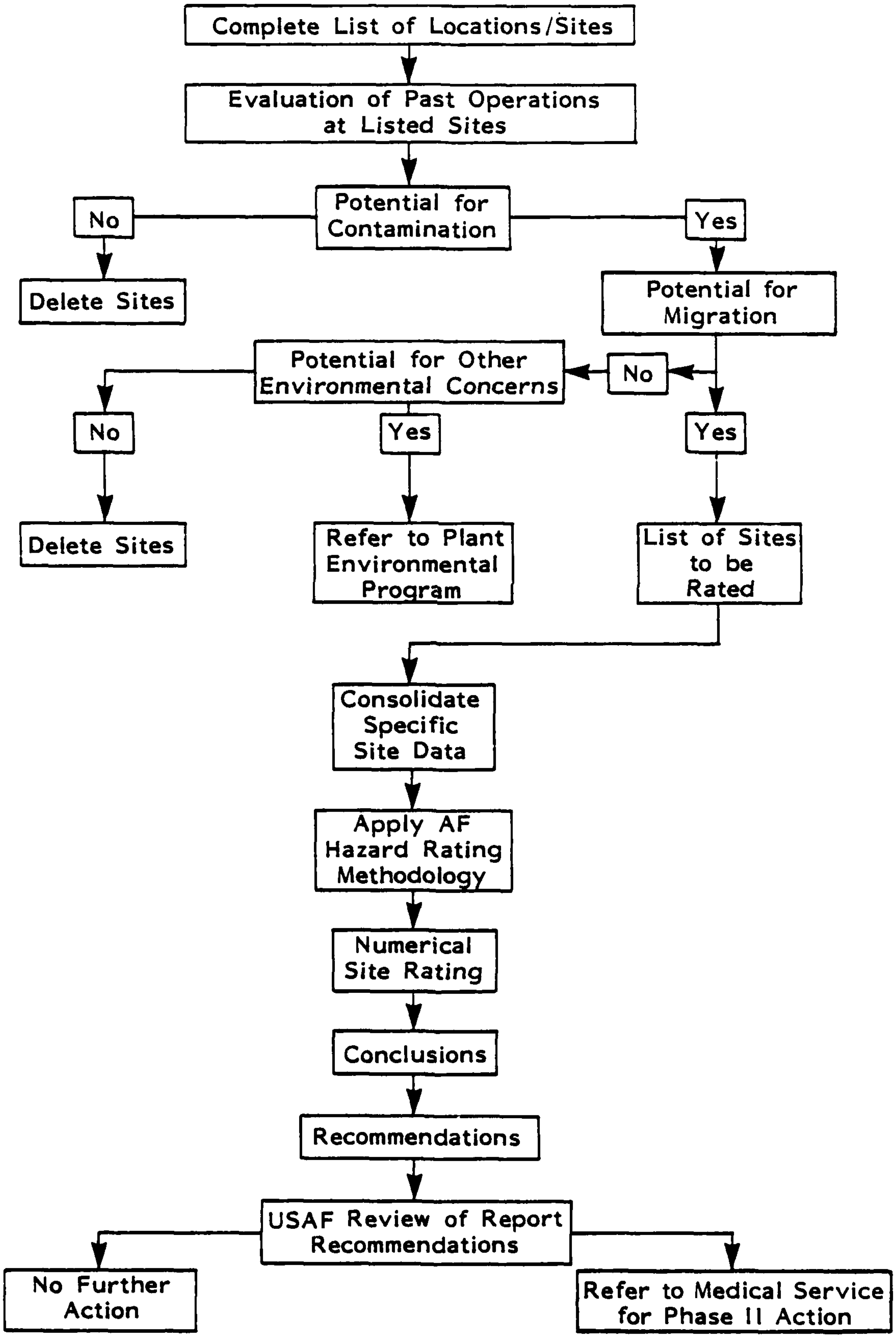
The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources at the plant. A master list of industrial shops is presented in Appendix D. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour of the identified sites was then made by the ES Project Team to gather site-specific information including: (1) general characteristics of waste management practices; (2) visual evidence of environmental stress; (3) the presence of nearby drainage ditches or surface water bodies; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential existed for hazardous material contamination at any of the identified sites using the Decision Tree shown in Figure 1.1. If no potential existed, the site was deleted from further consideration. For those sites where a potential for contamination was identified, a determination of the potential for migration of the contamination was made by considering site-specific conditions. If there were no further environmental concerns, then the site was deleted. If there are other environmental concerns then these are refered to the plant environmental program. If the potential for contaminant migration was considered significant, then the site was evaluated and prioritized using the Hazard Assessment Rating Methodology (HARM). A discussion of the HARM system is presented in Appendix F.

PHASE I INSTALLATION RESTORATION PROGRAM

DECISION TREE



SECTION 2
INSTALLATION DESCRIPTION

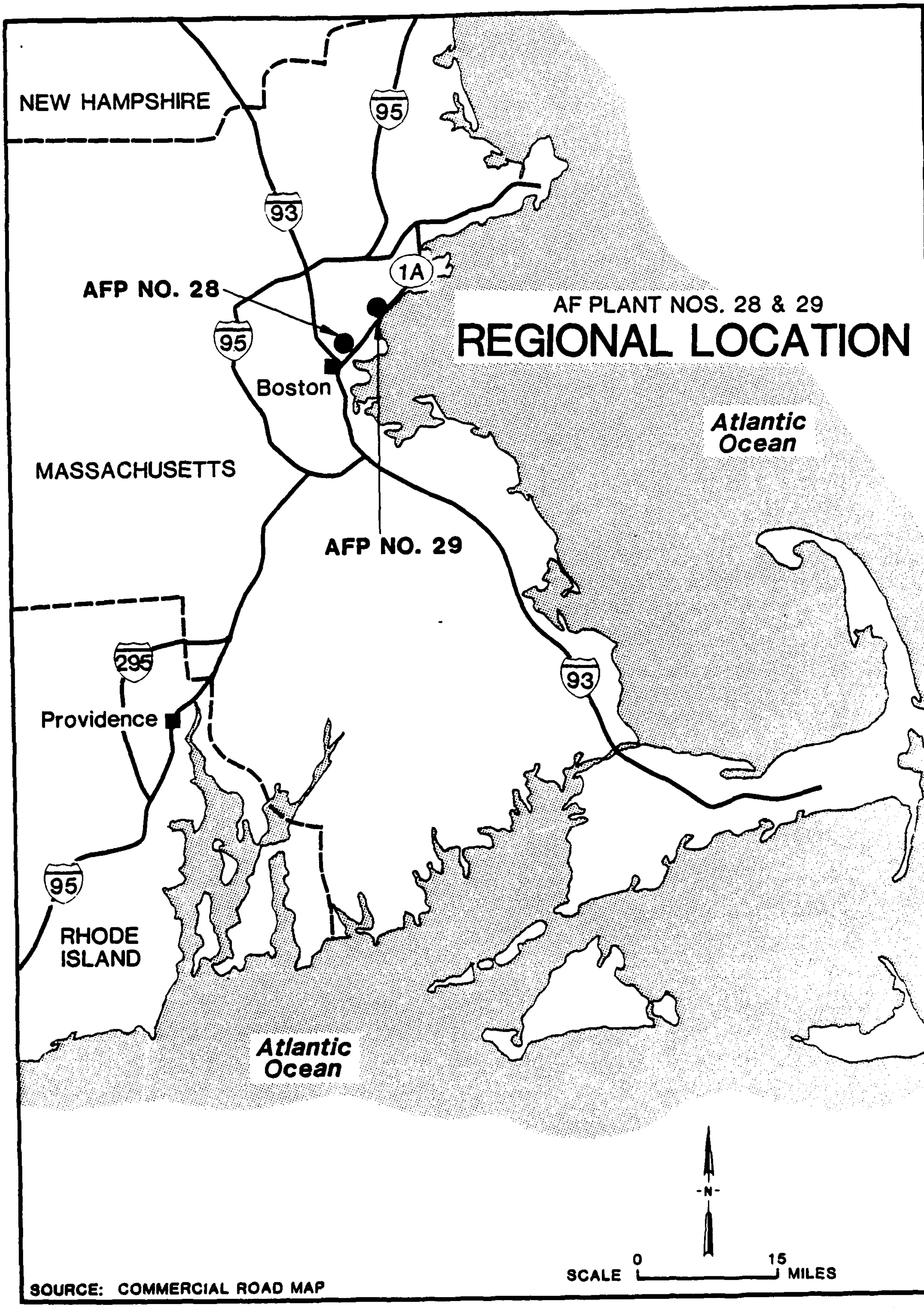
LOCATION, SIZE AND BOUNDARIES

Air Force Plant No. 28

Air Force Plant (AFP) No. 28, otherwise known as General Electric Everett Plant Operation, is located in Essex County, Massachusetts, within the city limits of Everett (Figure 2.1 and 2.2). The City of Everett is approximately two miles due north of Boston. The plant site is located on a 43-acre tract between the residential community of West Everett (estimated population of 5,000) to the east and the Malden River to the north and west. The facility is comprised of a large manufacturing plant and 10 smaller buildings that together occupy a total of 344,342 square feet of floor space (Figure 2.3). Land uses south of the General Electric Company (GE) Plant include the Gray Line Bus Company garage (formerly occupied by the GE Everett Foundries Plant) and a commercial park with businesses engaged in light industrial activities. To the southwest, the AVCO Manufacturing Plant occupies property that borders the Malden River and was once the site of the Everett Public Sanitary Landfill during the 1940's and early 1950's.

Air Force Plant No. 29

Air Force Plant No. 29 is located in the General Electric River Works Facility in Lynn, Massachusetts (Figure 2.1 and 2.2). The River Works facility consists of four separate organizational entities which include the Aircraft Engine Business Group; Lynn Utilities operations; Lynn Relations Operations; and the Industrial Marine Steam Turbine Division. The Air Force portion of the facility is part of the Aircraft Engine Business Group and is housed in the group 29 buildings. The group 29 buildings are located in the southwest corner of the River Works facility and are comprised of a main assembly building, 12 minor buildings and the bulk fuel farm that together occupy 184,201 square feet within an eight-acre area (Figure 2.4).


NEW HAMPSHIRE
95
93
1A
AFP NO. 28
AF PLANT NOS. 28 & 29
REGIONAL LOCATION
95
Boston
Atlantic
Ocean
MASSACHUSETTS
AFP NO. 29
295
93
Providence
95
RHODE
ISLAND
Atlantic
Ocean
-N-
SCALE 0 15 MILES
SOURCE: COMMERCIAL ROAD MAP

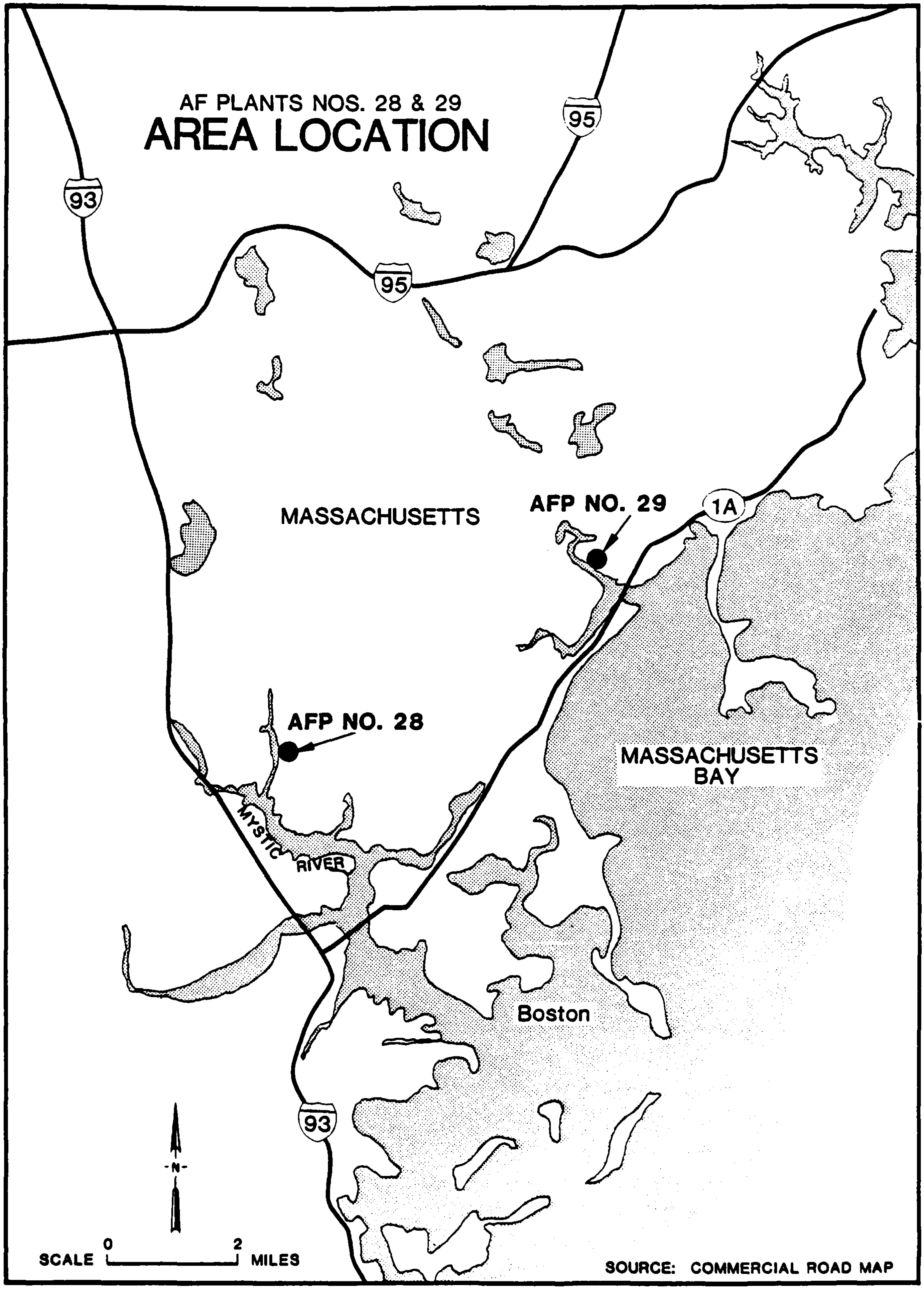
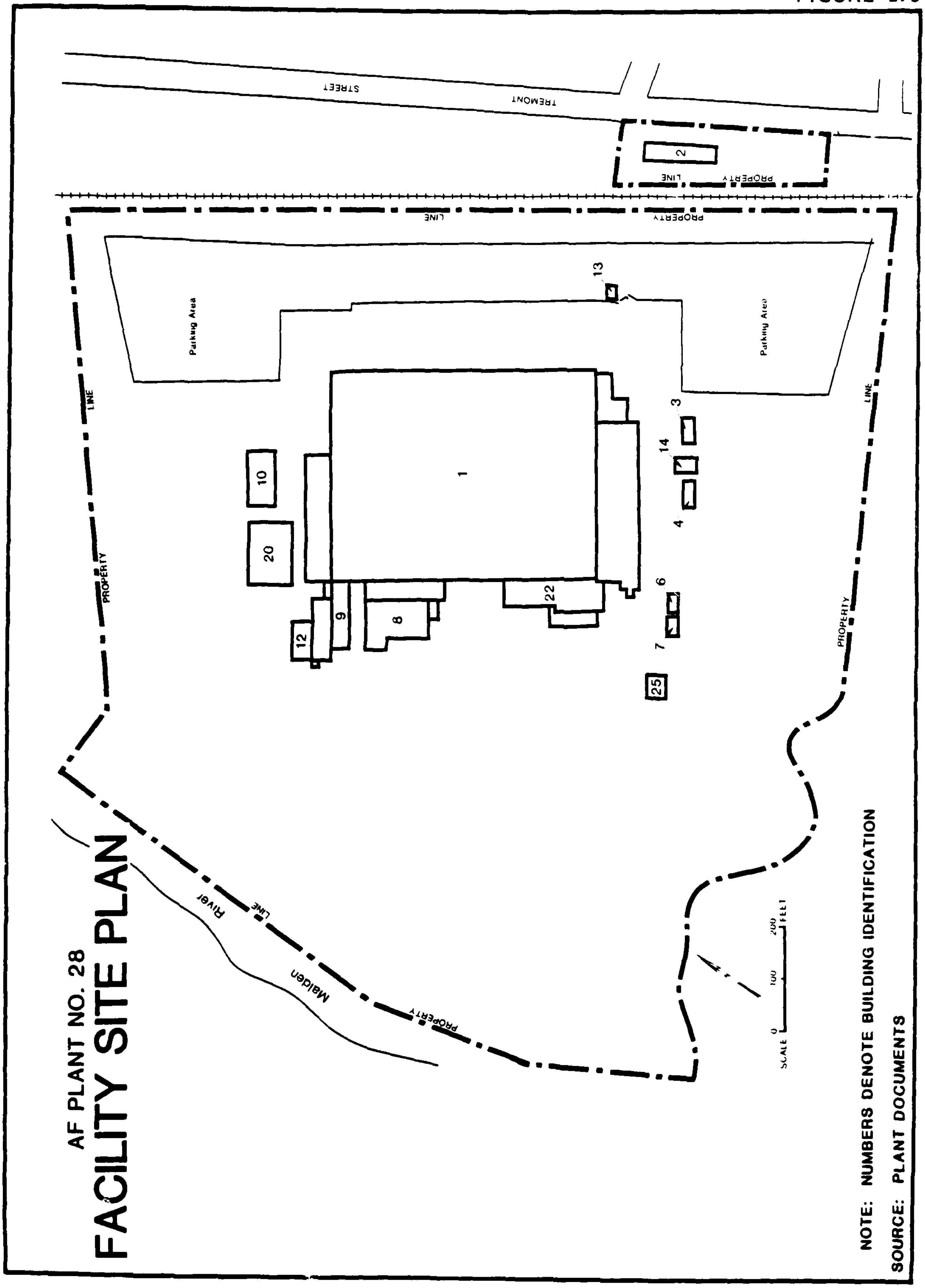
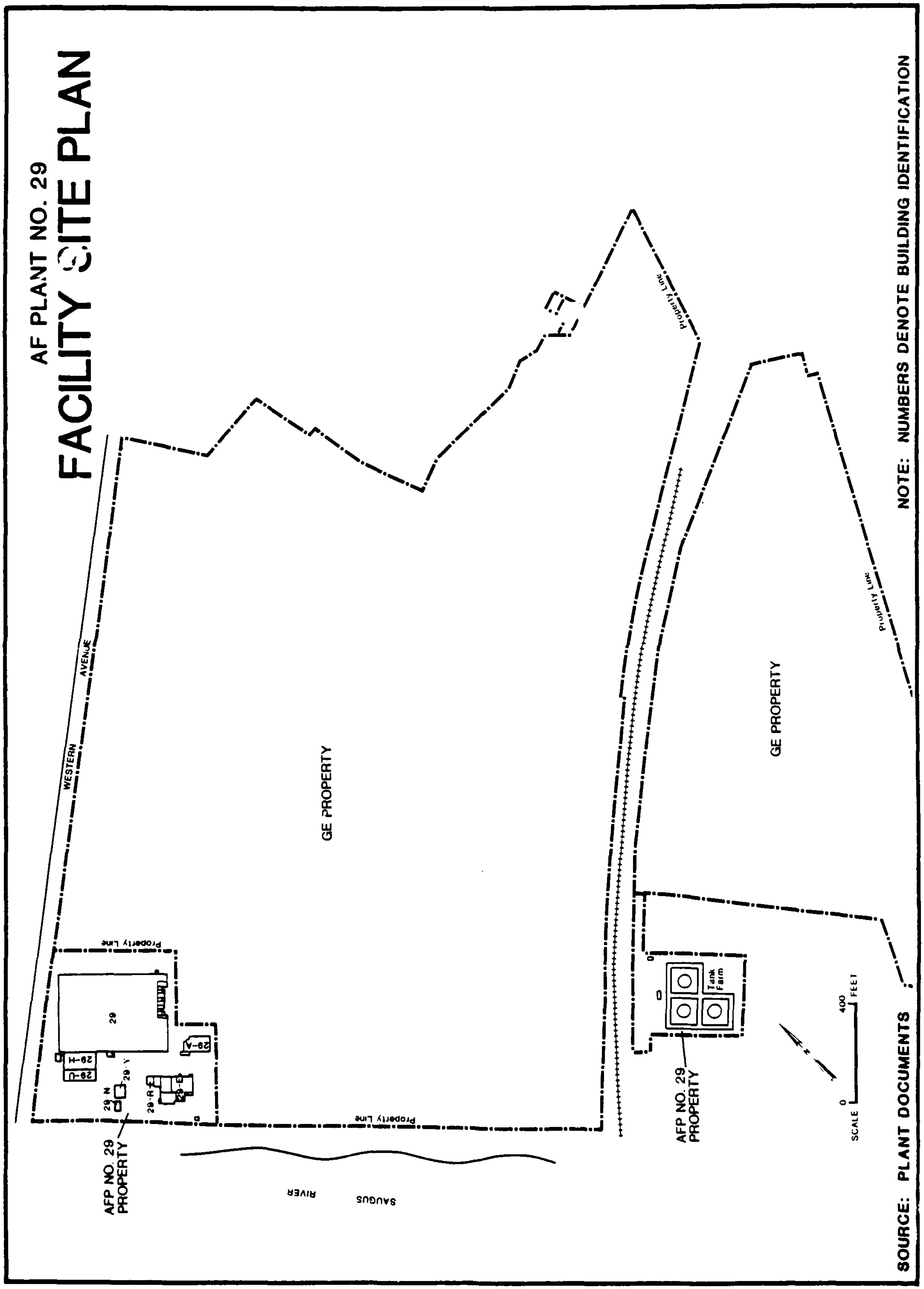

AF PLANTS NOS. 28 & 29
AREA LOCATION
93
95
95
MASSACHUSETTS
AFP NO. 29
1A
AFP NO. 28
MYSTIC
RIVER
MASSACHUSETTS BAY
Boston
93
N
SCALE 0 2 MILES
SOURCE: COMMERCIAL ROAD MAP

FIGURE 2.3


AF PLANT NO. 28
FACILITY SITE PLAN
TREMONT STREET
PROPERTY LINE
Parking Area
Parking Area
Malden River
SCALE 0 100 200 FEET
NOTE: NUMBERS DENOTE BUILDING IDENTIFICATION
SOURCE: PLANT DOCUMENTS



AF PLANT NO. 29
FACILITY SITE PLAN

NOTE: NUMBERS DENOTE BUILDING IDENTIFICATION

SOURCE: PLANT DOCUMENTS

Surrounding land uses include residential to the north, residential and commercial businesses to the northwest (including an auto junk yard, bus garage and several restaurants) and the General Electric Company (GE) Plant facility to the east. The Saugus River borders the River Works facility to the southwest.

HISTORY

Air Force Plant No. 28

In 1941, construction was completed on AFP No. 28 and GE began industrial operations at the facility. Initially, the production of aircraft super chargers was the plant's primary manufacturing operation. From the late 1940's to the present, AFP 28 has manufactured aircraft engines and is currently producing the CF6, CFM56, T700, F404 and the F101. Since 1941, the industrial activities performed at AFP No. 28, with the exception of the heat treatment and test cell operations which were added in the 1950's, have remained virtually the same and include machining, metal stamping, welding, grinding, cleaning and parts testing. Plating was performed from 1941 to 1978. A chronology of the facility construction is depicted in Table 2.1.

Air Force Plant No. 29

AFP No. 29 was constructed in 1943 and was an Air Force facility until GE purchased the plant in 1983. AFP No. 29 was originally built as a super charger test and assembly plant during World War II. Expansion of the plant occurred during the 1950's and 1960's including the addition of several jet engine test cells and storage areas. A chronology of the facility construction is listed in Table 2.1. GE activities at AFP No. 29 have remained virtually the same which include aircraft engine testing, disassembly, lubricating, cleaning and assembly. Operations include, degreasing, electrochemical grinding, engine maintenance, metal washing, parts cleaning and stress fracture testing.

TABLE 2.1

CHRONOLOGY FOR CONSTRUCTION

Air Force Plant No.	Building No.	Principal Function	Year Built
28	1	Manufacturing	1941
28	3	Garage	1941
28	4	Cooling Tower	1941
28	9	Oil House	1942
28	8	Heat Treating	1958
28	20	Raw Stock Storage	1960
29	29	Manufacturing	1943
29	29-A	Air Station and Testing	1944
29	29-C	Testing	1944
29	29-E	Testing	1945
29	29-H	Testing	1958
29	29-M	Testing	1951
29	29-N	Oily Water Treatment	1976
29	29-O	Testing	1951
29	29-R	Testing	1956
29	29-U	Testing	1966
29	29-Y	Storage	1976

SECTION 3

ENVIRONMENTAL SETTING

SECTION 3

ENVIRONMENTAL SETTING

The environmental setting of Plants 28 and 29 is described in this section with an emphasis on the identification of natural features that may promote the movement of hazardous waste contaminants. Environmental conditions pertinent to the study are summarized at the conclusion of this section.

CLIMATE

The climate of the Boston area is described as humid with coastal moderating influences (Sinnott, 1982) and four distinct seasons. Frequent weather changes are common.

Two climatic features of interest in determining the potential for the movement of contaminants are net precipitation and rainfall intensity. Net precipitation is an indicator of the potential for leachate generation and is equal to the difference between precipitation and evaporation. Rainfall intensity is an indicator of the potential for excessive runoff and erosion. The one-year, 24-hour rainfall event is used to gauge the potential for runoff or erosion and is reported to be 2.5 inches. Net precipitation for the study area is 18 inches as determined from current meteorological data (NOAA, 1984). The mean annual precipitation at the base for the period 1930 to 1960 is 44 inches and the mean annual lake evaporation for the area is 26 inches (NOAA, 1977). The substantial net precipitation figure indicates that the potential for rainfall to infiltrate surface soils exists. The relatively low one-year, 24-hour rainfall value indicates a low potential for runoff and soil erosion.

GEOGRAPHY

USAF Plants 28 and 29 are situated on the Coastal Lowlands subdivision of the New England physiographic province (Denny, 1982). The

lowlands exist as a narrow linear feature extending along the coast from New Jersey to Houlton, Maine near the Canadian border. They are characterized by maturely eroded and glaciated peneplains inland and broad level areas nearer to the coast. Glacial topographic features such as drift, moraines and drumlins are common, as are marine estuaries, beaches, low terraces and tidal flats. The land surface is generally level in appearance at the two plant sites.

Topography

Study area local relief is primarily the result of filling and construction, or other site use modifications. Maximum local relief at both plants is seldom more than ten feet, usually along major stream embankments. Typical surface elevations at Plant 28 average 12 feet, National Geodetic Vertical Datum of 1929 (NGVD) and 15 feet, NGVD at Plant 29.

Drainage

Drainage of plant land areas is accomplished by overland flow to diversion structures and finally to area surface waters. Plant 28 surface waters drainage is directed to small creeks north and south of the plant or directly to the Malden River. The Malden's water levels are maintained at a relatively uniform elevation by a lock and dam located downstream from the plant, just below its confluence with the Mystic River. Plant 29 drainage is first run through oil-water separators and then discharged to the adjacent Saugus River. The Saugus River water levels are uncontrolled and are subject to a 9.2 foot tidal fluctuation (from Lynn Quadrangle 7.5-minute topographic map, 1970). Figures 3.1 and 3.2 depict the drainage conditions of Plants 28 and 29, respectively.

Surface Soils

Surface soils of the Southern Essex County area have been studied by the USDA, Soil Conservation Service (1984). The soils of both Plants 28 and 29 are classified "Ur," which is urban land. This classification signifies that native soils have been removed, altered or buried as a result of developmental activities. The properties and characteristics of urban lands have not been estimated as they are extremely variable. Subsurface exploration conducted at both plant sites indicates that

FIGURE 3.1

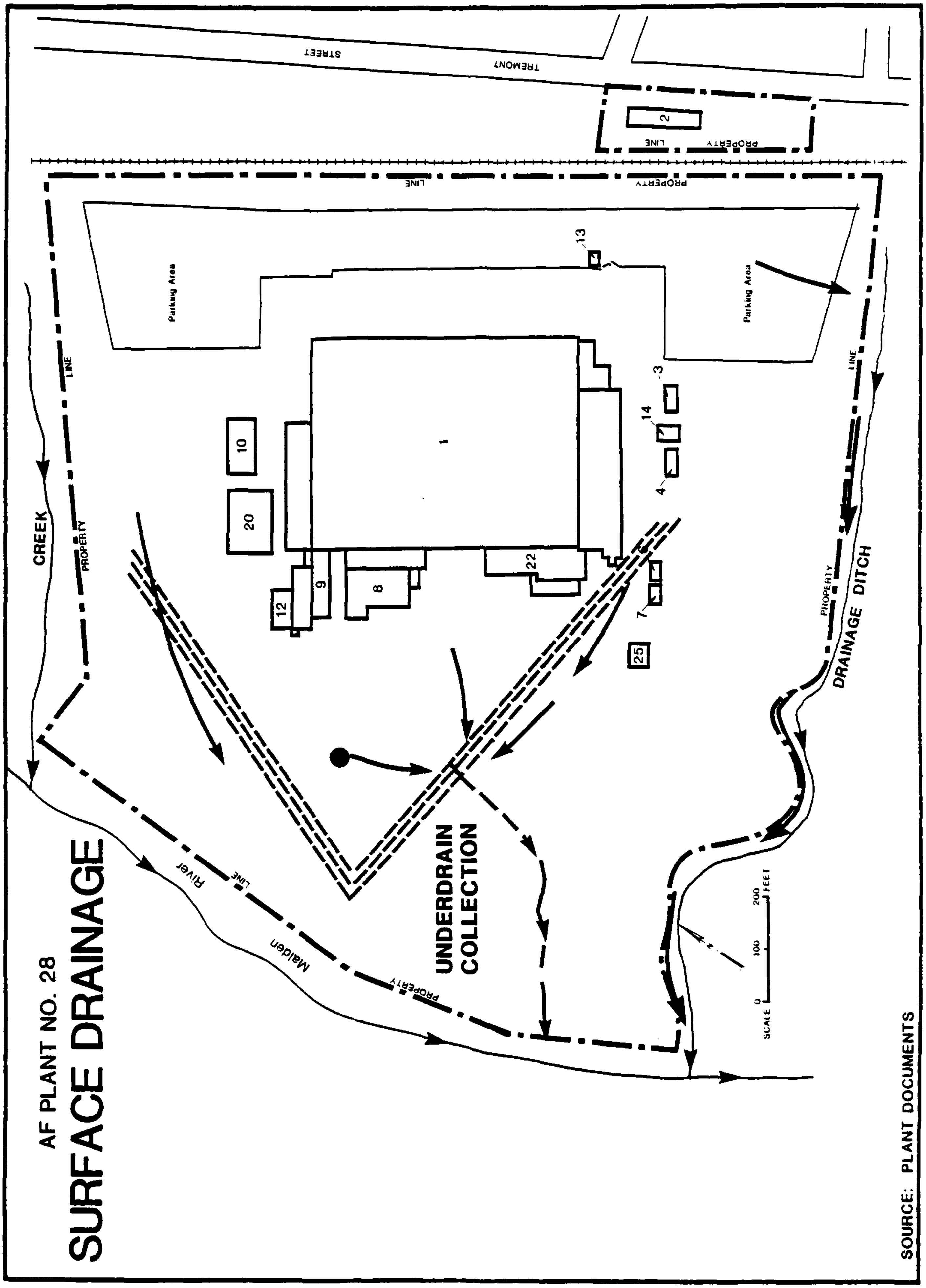
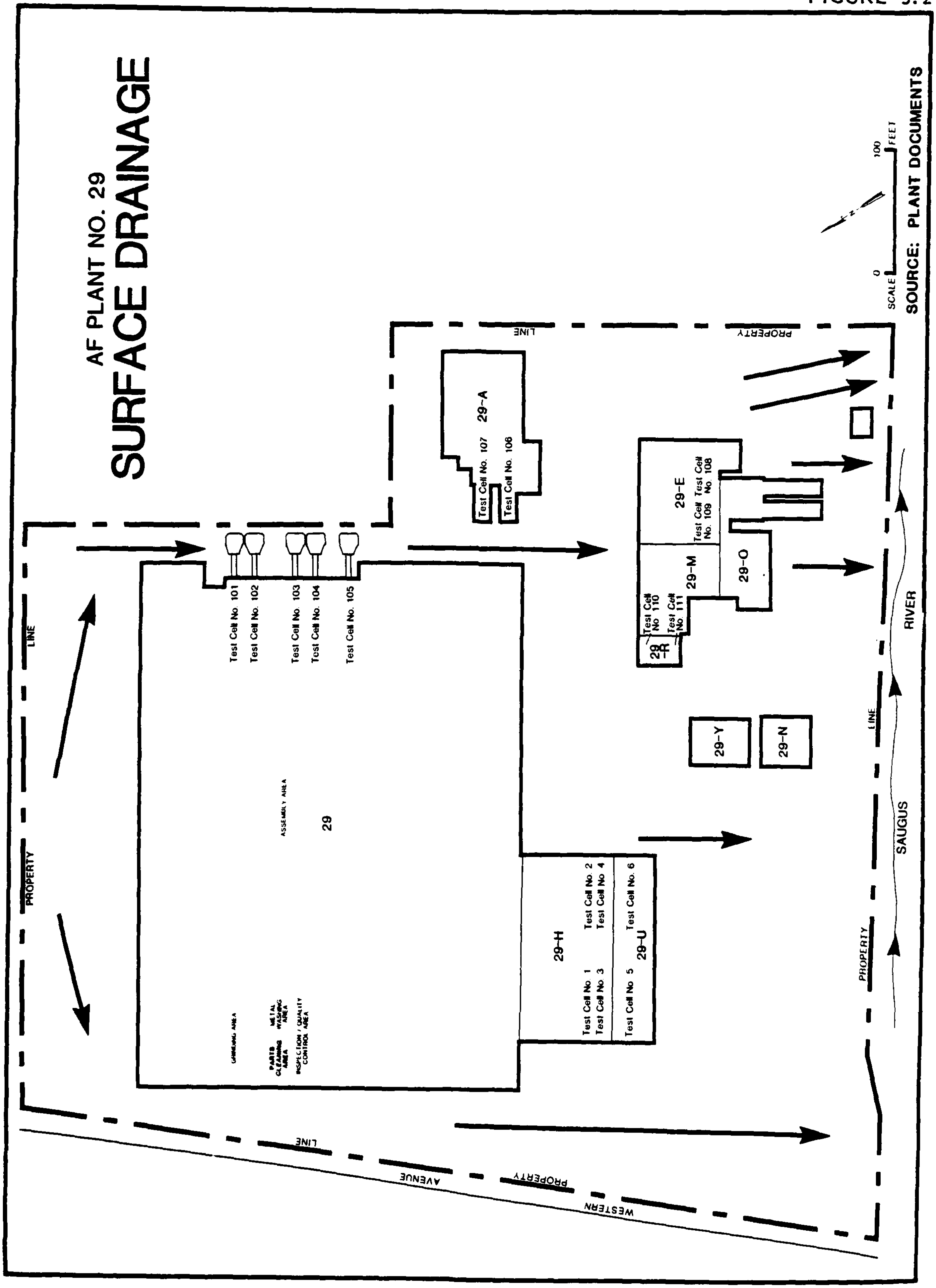

AF PLANT NO. 28
SURFACE DRAINAGE
TREMONT STREET
PROPERTY LINE
Parking Area
Parking Area
CREEK
DRAINAGE DITCH
UNDERDRAIN COLLECTION
Malden River
1
2
3
4
7
8
9
10
12
13
14
20
22
25
SCALE 0 100 200 FEET
SOURCE: PLANT DOCUMENTS

FIGURE 3.2



AF PLANT NO. 29
SURFACE DRAINAGE
SOURCE: PLANT DOCUMENTS
SCALE
0
100
FEET
PROPERTY
LINE
29-A
Test Cell No. 107
Test Cell No. 106
29-E
Test Cell No. 109
Test Cell No. 108
29-M
29-O
Test Cell No 110
Test Cell No. 111
29-R
29-Y
29-N
Test Cell No 101
Test Cell No. 102
Test Cell No 103
Test Cell No. 104
Test Cell No. 105
29
ASSEMBLY AREA
29-H
Test Cell No 1
Test Cell No 3
Test Cell No. 2
Test Cell No 4
29-U
Test Cell No 5
Test Cell No. 6
PARTS CLEANING AREA
METAL WASHING AREA
INSPECTION / QUALITY CONTROL AREA
SAUGUS
RIVER
WESTERN
AVENUE

fill, a heterogeneous mixture of natural and man-made materials forms the surface "soil" common to the two study sites. Significant segments of land area at the plants is also paved.

GEOLOGY

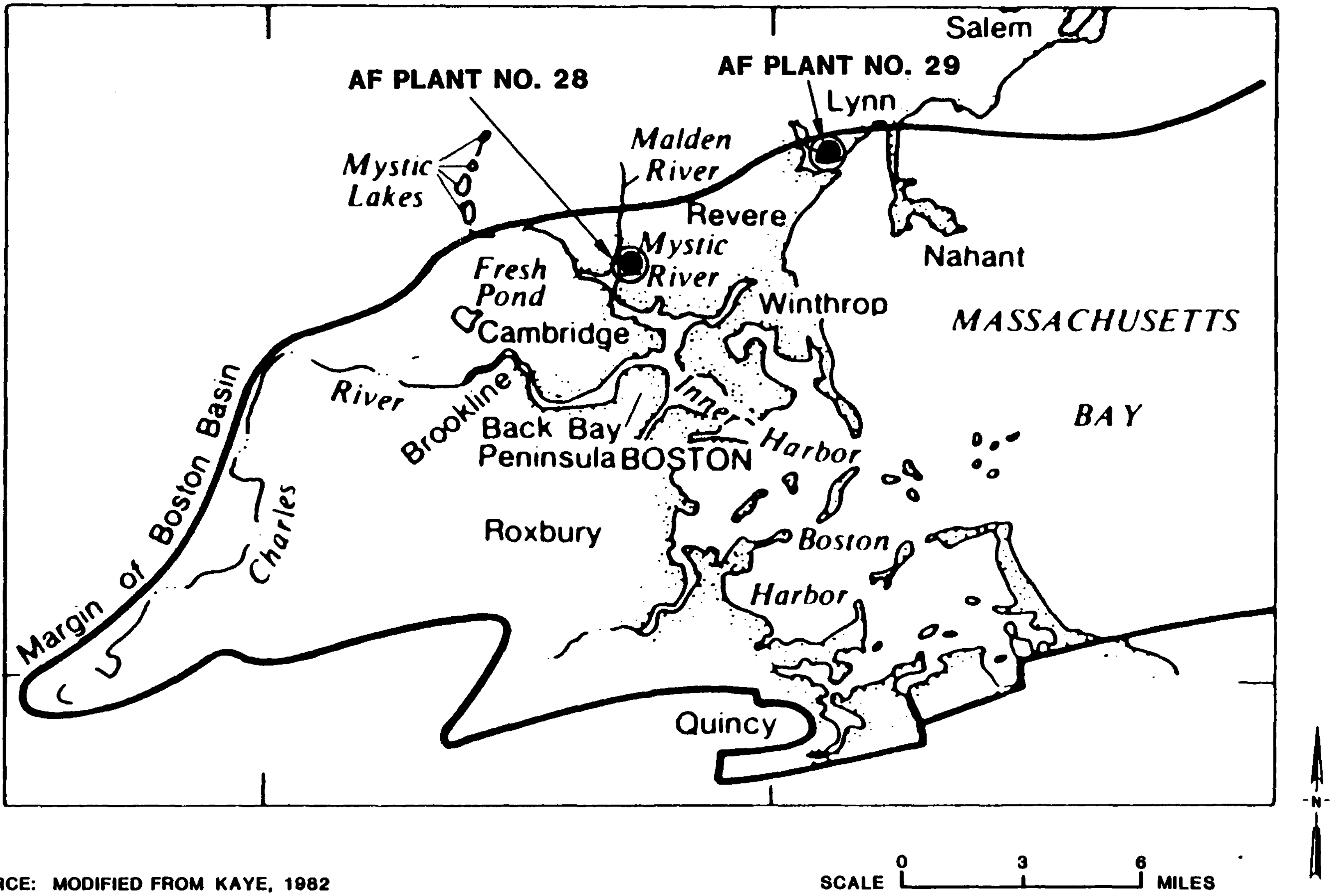
Information describing study area geology has been obtained from LaForge (1932); USGS (1967a and 1967b) and Kaye (1976, 1978 and 1982). Additional information has been obtained from an interview with a U.S. Geological Survey (USGS) scientist.

Both plant sites are located within the Boston Basin, a wedge-shaped, down-faulted body of sedimentary and volcanic rock, bordered landward by granitic rocks (Kaye, 1982). The rock's upper surface is highly variable. Figure 3.3 depicts the basin and the relative plant locations within it. The Paleozoic consolidated rocks forming the basin's basement are overlain by unconsolidated materials of both marine and terrestrial origin. The thickness of Pleistocene and Recent unconsolidated materials at Plant 28 is estimated to be approximately 142 feet (Delaney and Gay, 1980) and on the order of 87 feet at Plant 29 (plant test boring logs). The stratigraphy of the Pleistocene materials is quite complex and probably represents at least four distinct tills and outwash units which suggest several glacial episodes. A brief summary of site-specific surficial and bedrock geology follows.

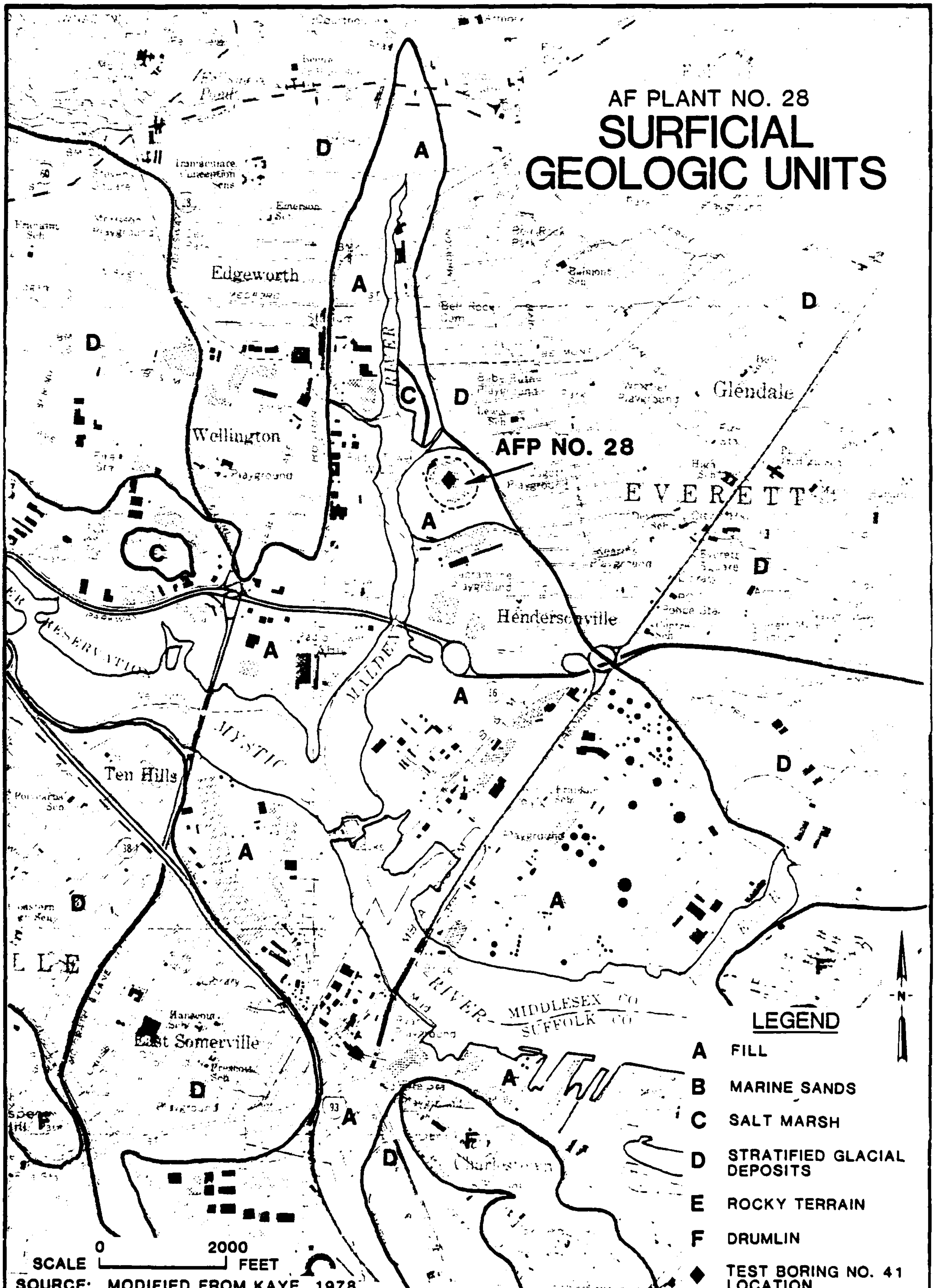
The surficial geology of the Plant No. 28 study area includes fill, salt marsh, stratified glacial deposits and drumlins (compiled from LaForge, 1932; USGS, 1967; Kaye, 1978 and plant documents). The distribution of these units relative to the plant are depicted on Figure 3.4. According to plant test borings (Figure 3.5 is the log of a representative boring, drilled prior to construction). The fill is the uppermost stratum, which overlies the salt marsh materials. The fill is a man-made unit placed to raise site elevations out of potential flood levels and to provide a stable construction platform. The salt marsh is associated with stream and/or tidal lands development and may include recent alluvium (fine sand, silt, clay, etc.). The stratified glacial deposits generally underlie the salt marsh materials and are associated with Pleistocene glacial activity. The drumlins, low, rounded, elliptical hills composed primarily of fine-grained soils, are unique features of

AF PLANT NOS. 28 & 29

THE BOSTON BASIN



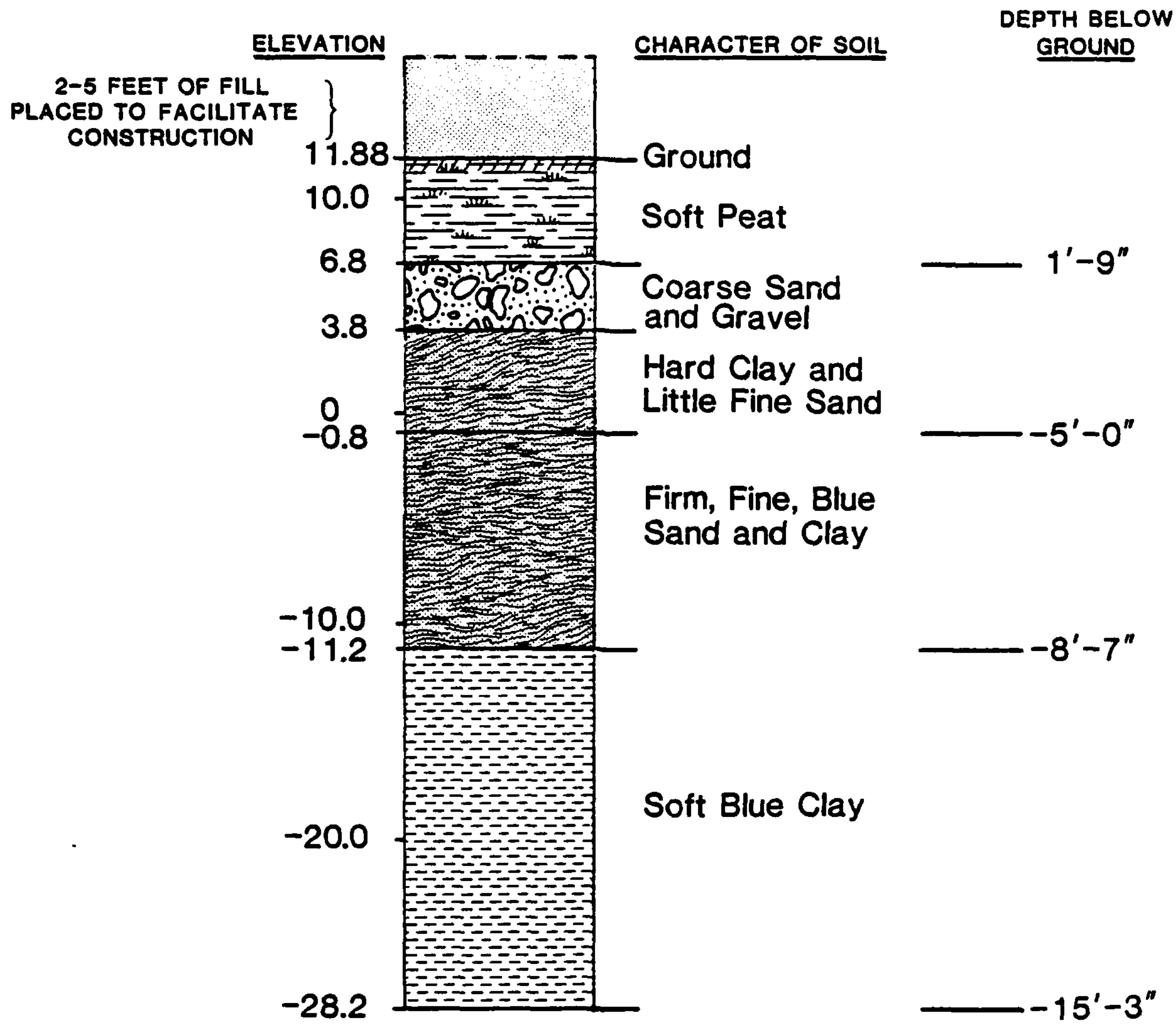
SOURCE: MODIFIED FROM KAYE, 1982



SOURCE: MODIFIED FROM KAYE, 1978

AFP NO. 28

LOG OF TEST BORING NO. 41



GROUND-WATER LEVEL NOT RECORDED

NOTE: LOCATION SHOWN ON FIGURE 3.4

SOURCE: MODIFIED FROM PLANT DOCUMENTS

glacial terrain. Their elongation is concordant to the direction of glacial movement. The major Plant 28 study area geologic units are summarized as follows:

Symbol	Unit	Lithology	Thickness, feet	Topographic Expression
A	Fill	Miscellaneous sand, hilt, clay, gravel, wood, metal, concrete, bricks, etc.	2-5	Level areas near swamps or streams
C	Salt Marsh	Peat, organic mateoials, fine sand, silt, clay	3-15	Swamps, tidal zones
D	Stratified	Gravel, sand, silt clay, with cobbles	10-125	Flat to sloping valley floors; border areas and terraces
F	Drumlin	Clay matrix with silt, sand, gravel, cobbles and boulders	25-150	Low rounded hills

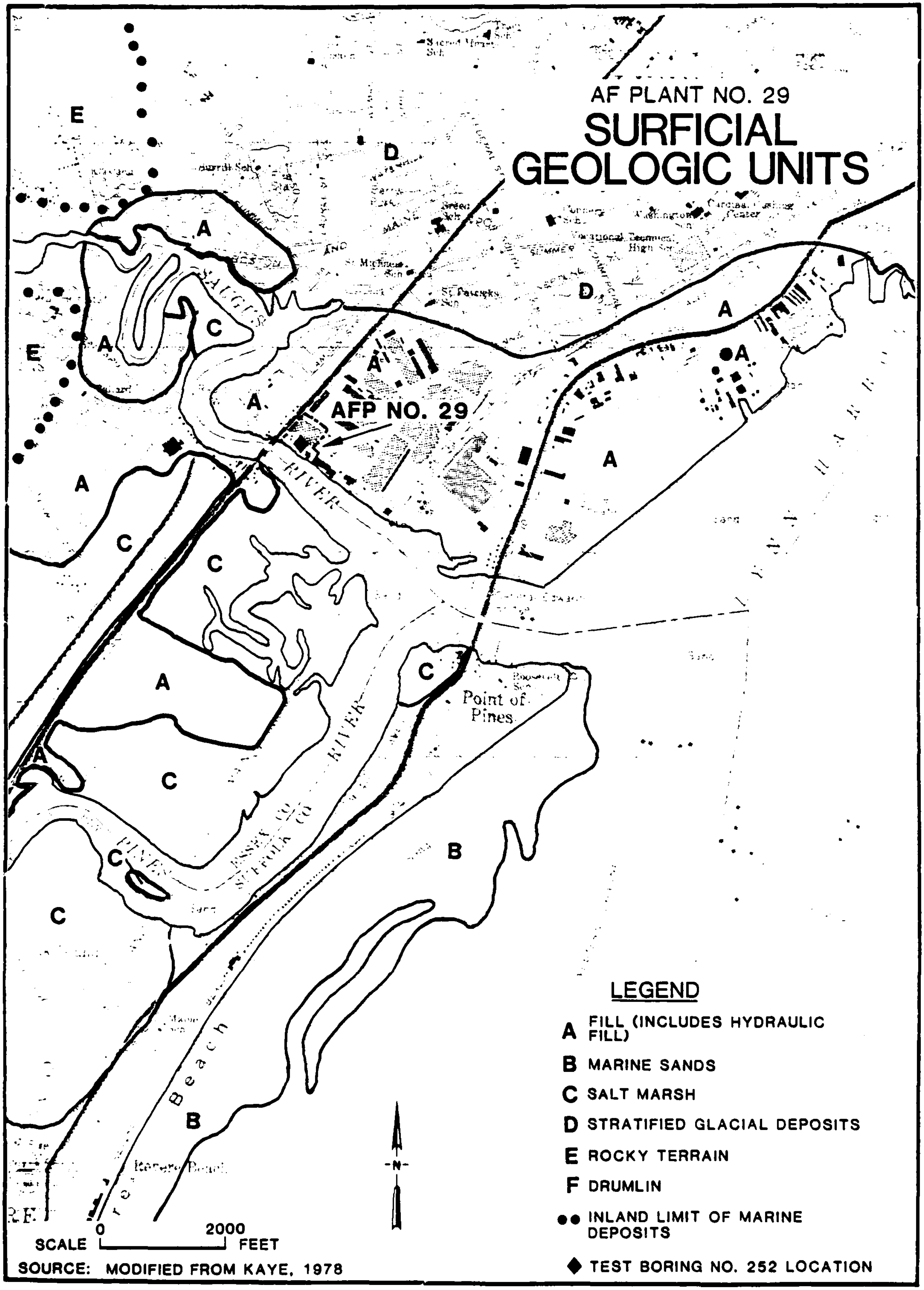
The bedrock geology of Plant No. 28 in Everett is dominated by metamorphic rocks of the Antietam, Braintree, Cambridge, Harpers, Hoppin, Jacksonburg, Martinsburg, Normanskill, Peach Bottom and Weymouth Formations (USGS, 1967a). The rocks of these geologic units are reported to be argillaceous materials in various stages of metamorphism. They include dense, dark argillite, siliceous shale, thin-bedded, locally carbonaceons slaty shale, slate, phyllite, fine-grained quartz mica schist and medium grained quartz albite schist. Most stratigraphic sequences include sandstone and graywacke; locally limestone or volcanic tuff may be present. The rocks are generally well-bedded and possess steep dips. They typically split readily along bedding, cleavage or foliation planes. Cross joints are commonly closely spaced and faulting is extensive. The rocks are easily cored and excavation is moderately easy, an indication of relative incomplete induration. In the study area, bedrock is normally sound and unweathered, except where sections of argillite have altered to form a soft white clay.

The surficial geology of the Plant No. 29 study area includes fill, marine sands, salt marsh materials, stratified glacial deposits and

rocky terrain (from LaForge, 1932; USGS, 1967a and 1967b; Kaye, 1978 and plant documents). The distribution of these units is depicted on Figure 3.6. Figure 3.7 is the log of a pre-construction test boring which illustrates generalized subsurface conditions at the plant. The uppermost unit is the man-made fill utilized to create stable construction areas. It, in turn, is underlain by marine sands (or salt marsh locally) and the stratified glacial deposits, which are exposed at ground surface generally north of the plant. Rocky terrain, a generalization that includes both rock outcrops or areas of thin glacial drift cover, is mapped in two areas west and northwest of the plant. The significant Plant 29 study area geologic units are summarized as follows:

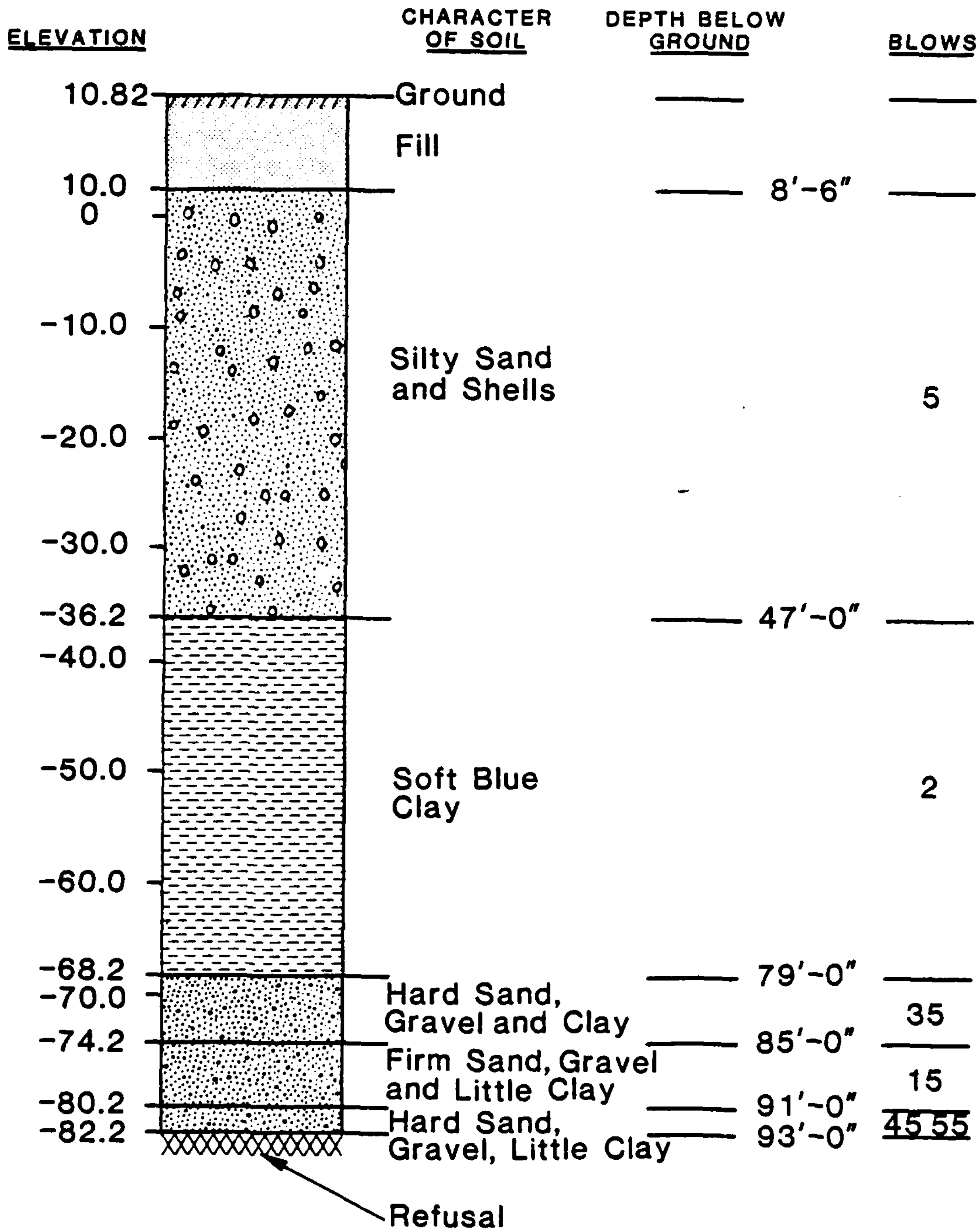
Symbol	Unit	Lithology	Thickness, feet	Topographic Expression
A	Fill	Miscellaneous silt, hand, gravel, concrete, slag, etc.	2-10	Level areas near waterways
B	Marine	Silty sand and shells	2-20	Shore and beach areas
C	Salt Marsh	Peat, organic materials, fine sand, silt, clay	3-15	Swamps, tidal zones
D	Stratified glacial deposits	Gravel, sand, silt, clay, with cobbles	10-125	Flat to sloping valley floors; border areas and terraces.
E	Rocky terrain	Exposed bedrock or thin, discontinuous soil cover over rock	9-	Hills or upland upland area

The bedrock geology of Plant No. 29 in Lynn is dominated by commonly altered and slightly metamorphosed volcanic rocks of the Brighton, Catoctin, Lynn Volcanic, Mattapan Volcanic and Spencer Hill Formations (USGS, 1967a). The rocks of these geologic units include lava flows, welded tuffs and pyroclastic deposits with feeder dikes and sills. They are typically strongly altered and partially metamorphosed. The rock


AF PLANT NO. 29
SURFICIAL GEOLOGIC UNITS
AFP NO. 29
A
B
C
D
E
Point of Pines
RIVER
Beach
LEGEND
A FILL (INCLUDES HYDRAULIC FILL)
B MARINE SANDS
C SALT MARSH
D STRATIFIED GLACIAL DEPOSITS
E ROCKY TERRAIN
F DRUMLIN
●● INLAND LIMIT OF MARINE DEPOSITS
◆ TEST BORING NO. 252 LOCATION
N
SCALE 0 2000 FEET
SOURCE: MODIFIED FROM KAYE, 1978

AFP NO. 29

LOG OF TEST BORING NO. 252



GROUND-WATER LEVEL NOT RECORDED

SEPT. 1942

NOTE: BORING LOCATION SHOWN ON FIGURE 3.6
SOURCE: MODIFIED FROM PLANT DOCUMENTS

types present are hard, resistant felsite, rhyolite, andesite and basalt. The individual rock type varies over short distances and is usually considered collectively within associated groups. The rocks are normally massive and fractured. Jointing is described as strong and usually closely spaced. Bedding or depositional trends and attitudes are said to be highly variable. Weathering occurs only along joints or at the bedrock surface. The volcanics are typically difficult to core, an indication of their relative induration.

GROUND-WATER RESOURCES

Project area ground-water resources have been obtained from Dean (1982); Delaney and Gay (1980a and 1908b); Frimpte (1982); Hodges (1969); U.S. Geological Survey (1967a and 1967b); and Sinnott (1982). Ground-water information pertinent to the USAF plants has been briefly summarized.

Plant No. 28

Plant No. 28 lies adjacent to the Malden River, in swampy areas or marshes were common prior to construction (LaForge, 1932), where filling, paving and construction have modified local hydrology. The significant hydrogeologic units encountered during test boring and well installation work conducted at Plant No. 28 include:

- o Unconsolidated units: fill, marsh deposits and stratified glacial deposits
- o Consolidated unit: metamorphic rocks

The unconsolidated units consist of miscellaneous fill materials, peat, organic silt, fine sands and clays (possibly alluvium associated with the development of the Malden River) and course sands and gravels typical of the stratified glacial deposits.

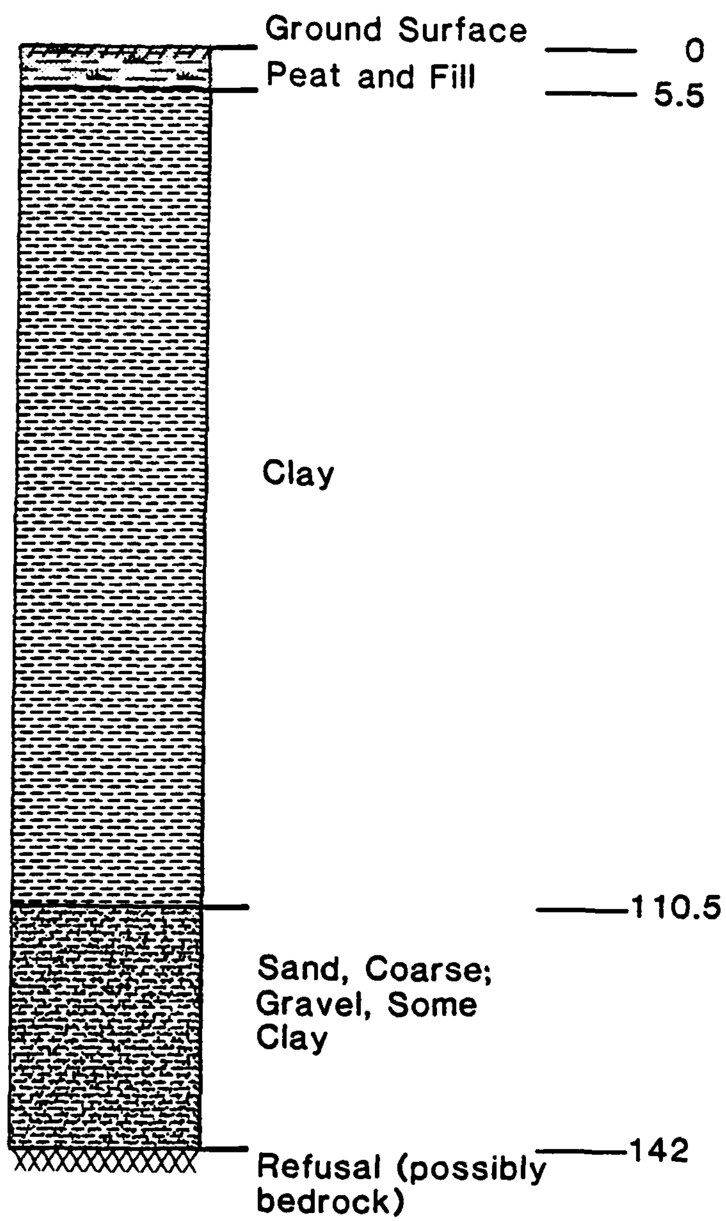
At test boring location No. 41 (Figures 3.4 and 3.5) the fill, marsh and glacial materials are in physical contact and therefore, probably act as a single hydrologic unit. The shallow system is not used as a source of water supplies. A short distance away, a well was drilled, the log of which suggests a dramatic change in local geology. Figure 3.8 the log of the AFP No. 28 well, depicts a thick (105 foot)

FIGURE 3.8

AFP NO. 28

LOG OF PLANT NO. 28 WELL

(USGS NO. X 19)



GROUND-WATER LEVEL NOT RECORDED

NOTE: DEPTH IN FEET BELOW GROUND SURFACE

SOURCE: MODIFIED FROM DELANEY AND GAY, 1980 B, PAGE 23.

clay layer which separates upper strata from water bearing zones at greater depth. Presumably, the well is screened into the glacial sand and gravel, between 110.5 and 142 feet below grade and encountered bedrock at the greater depth. The well is not in use at the present time. Delaney and Gay (1980a) report that the glacial aquifer is prolific, having yields in the 100 to 300 gpm range.

Ground water is generally present under water table (unconfined) conditions in unconsolidated strata, but may be acting under artesian (confined) conditions in deeper strata. According to a report by Perkins, Jordan, Inc., ground-water recharge to unconsolidated units occurs just west of the main plant building (probably via precipitation) and proceeds to the Malden River. Flow is probably stable as a dam controls the Malden River's pool elevation. An underdrain system near the plant's manufacturing facility intercepts some shallow flow and has altered upper aquifer conditions locally. Figure 3.9, a ground-water contour map of the AFP No. 28 plant has been adapted from Perkins, Jordan, Inc. (1983). The information presented here is likely based on water levels observed in unsealed PVC tubes and is only applicable to the fill, marsh deposits, or other communicating strata.

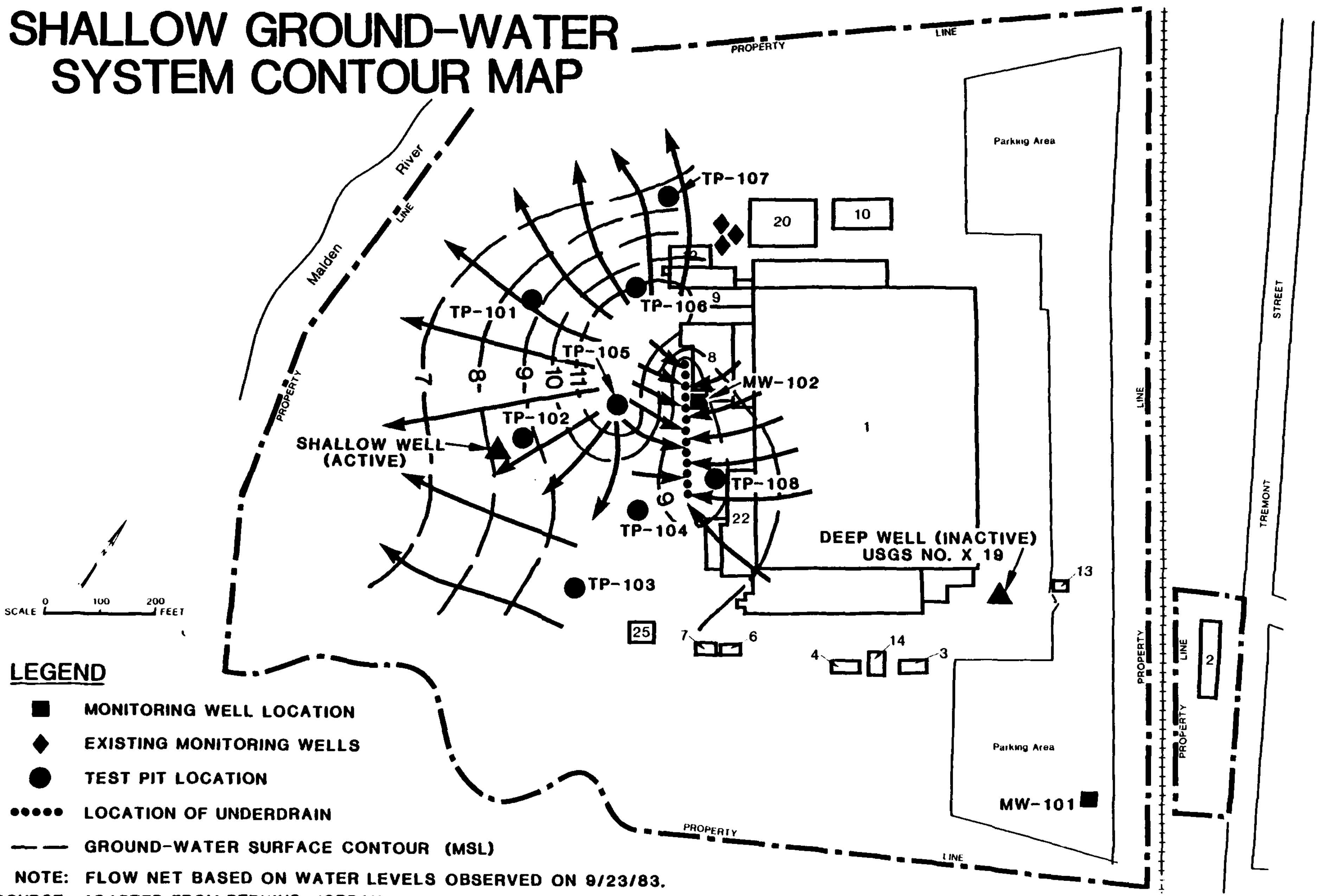
Ground-water is present at very shallow elevations at the AFP No. 28 facility, especially seasonally. To control high water levels, a shallow well connected to a series of four drains is utilized, shown on Figure 3.9. Discharge is directed to the Malden River.

The metamorphic rocks forming the deep unit contain water in joints, fractures, etc. but are not exploited for resources, consequently, little is known about them.

Ground-water quality monitoring has been performed at the AFP No. 28 facility to observe potential raw-material storage loss (the "existing wells" on Figure 3.9) and for possible underground oil sump leakage. No evidence of shallow aquifer water quality degradation has been observed. Another monitoring well (MW-101) has been strategically located to detect possible shallow aquifer contamination due to leakage from industrial operations adjacent to the USAF plant. A more detailed discussion is presented in Section 4 under <u>Spills and Leaks</u>.

AF PLANT NO. 28

SHALLOW GROUND-WATER SYSTEM CONTOUR MAP



LEGEND

- ■ MONITORING WELL LOCATION
- ◆ EXISTING MONITORING WELLS
- ● TEST PIT LOCATION
- ••••• LOCATION OF UNDERDRAIN
- — — GROUND-WATER SURFACE CONTOUR (MSL)

NOTE: FLOW NET BASED ON WATER LEVELS OBSERVED ON 9/23/83.

SOURCE: ADAPTED FROM PERKINS, JORDAN, INC., 1983

Plant No. 29

Plant No. 29 in Lynn, has been constructed in proximity to a major tidal water, the Saugus River, in a geologic setting somewhat similar to that of the AFP No. 28 plant. As in the case of Plant No. 28, filling, paving and construction have modified local hydrology. A review of plant test boring data indicates that the following hydrogeologic units are present at the plant:

- o Unconsolidated units: fill, marsh deposits, marine sands and glacial materials
- o Consolidated unit: volcanic rocks

The unconsolidated hydrogeologic units consist of fill, marsh deposits, marine sands and glacial materials. Boring data suggest that generally, the fill, consisting of silt, sand, gravel, bricks, metal, glass, etc. directly overlies the marine sands (refer to Figure 3.7) or the salt marsh deposits where they occur adjacent to the Saugus River. Boring data also indicate that a thirty foot thick clay layer separates the fill/marsh/marine materials from the underlying stratified glacial deposits. The fill/marsh/marine materials are present at ground surface, are in communication and likely act as a single hydrologic unit, and contain ground water at shallow depths (two-five feet according to Soil Conservation Service information). They are probably recharged by precipitation falling on exposed (unpaved) plant areas and discharge is most likely directed to the Saugus River. Ground water is probably brackish and is present under water table conditions. Ground-water flow in the shallow system is probably impacted by the nine foot tidal surge of the Saugus River, however, the extent of this influence is unknown. The lower unconsolidated unit, the stratified glacial deposits, was encountered by installation test borings at average depths of 60 to 80 feet below ground surface. Ground water is probably present in this unit under artesian conditions. Recharge occurs where the unit is exposed to precipitation or is in hydraulic communication with other water-bearing strata. The point of discharge and flow directions within this unit are uncertain. According to Delaney and Gay (1980a) the potential yield of stratified glacial deposits in the Plant 29 are is

less prolific (<100 gpm) than the same deposits are in the Plant 28 area.

The volcanic bedrock of the Plant 29 study area is a limited source of water supplies, and therefore, little is known of its resource potential. Ground water occurs in weathered, fractured or jointed zones at depths averaging 120 feet below grade (USGS, 1967a). Yields are reported to average nine gallons per minute. This unit is not known to be utilized as a source of water supplies in the vicinity of Plant 29.

Ground-water quality monitoring was conducted at Plant No. 29 as part of a remedial program performed during 1975 and 1976. The exploratory program consisted of auger borings and monitoring well installation to determine the extent and concentrations of fuel oil contamination leaking from plant facilities into the shallow aquifer. Ground-water contamination by petroleum products was confirmed. The remedial program consisted of the construction and operation of scavenger (recovery) wells installed at three locations to intercept contaminant flow and treatment of the contaminated ground water. Information reviewed as part of this study indicate that petroleum product contamination of ground water ranged from 0 percent (not detected) to 100 percent (sample saturation). Based on monitoring well data, the remedial recovery program has been generally successful. One recovery well located near Building 29E is still in operation.

GROUND-WATER QUALITY

Ground-water quality information from Delaney and Gay (1980a and 1980b) indicates that ground-water resources obtained from stratified glacial deposits or bedrock is generally of good quality. Iron and manganese concentrations may be excessively high in wells located near or in swamps. Wells adjacent to tidal zones may experience salt water intrusion which was observed at Plant 29, in the shallow (fill/marsh/ marine deposits) aquifer by the Dufresne-Henry study. No definitive ground-water quality information is available for either the Plant 28 or 29 study areas as there are no local ground-water consumers.

AREA WATER RESOURCES

The Everett area and Plant 28 obtain water supplies from municipal surface water sources and transmission facilities operated by the Metropolitan District Commission (MDC). The Lynn area and Plant 29 obtain water supplies from municipal surface water sources and transmission facilities operated by the MDC and the City of Lynn.

SURFACE WATER QUALITY

Plant 28 in Everett is located in the Mystic River drainage basin adjacent to the Malden River, a tributary of the major stream. The water use classification of the Malden is B (warm water fishery) for the protection and propagation of fish, other aquatic life, wildlife and for secondary contact recreation. Surface water quality monitoring of Plant 28 discharges is not performed on a routine basis as no contaminated flow is directed to local surface waters. Process waste water from the plant is discharged to the city collection and sewage treatment system.

Plant 29 in Lynn is located in the north coastal drainage basin adjacent to the Saugus River. The water use classification of the Saugas River is SB, for protection and propagation of fish, other aquatic life, wildlife and for secondary contact recreation. Also, the Saugus River is designated as a shellfish harvesting zone (a restricted shellfish area). Plant 29 maintains a total of six discharge points to the Saugus River, all of which are monitored on a routine schedule according to the NPDES permits. Although the permitted discharges are first directed through one or more oil-water separators, a review of historical water quality data indicates that oil and grease concentrations in water discharged to the Saugus River have been a periodic problem (interview with a MDEQE official, Ida Babroudi, March 15, 1984).

BIOTIC ENVIRONMENT

Both Plants 28 and 29 are situated in highly urbanized areas which deny habitat to most forms of wildlife. Historically, however, habitats did exist at the present plant sites.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate that the following major points are relevant to the evaluation of past hazardous waste management practices at Plants 28 and 29.

- Climatic data indicates a high net precipitation for the study area, suggesting a potential for infiltration and/or contaminant migration. The one-year, 24-hour rainfall value is 2.5 inches; indicating low runoff and erosion potential.
- Surface materials of both plant sites consists of fill (sand, gravel, construction debris, etc.) which if unpaved, is considered to be permeable. A shallow water table is present in this stratum at both plants.
- The fill is part of an identified "shallow aquifer" present at both plants (probably acting in concert with marsh and marine sand deposits). The plants are located in recharge zones for this aquifer which likely discharges to local surface waters.
- A deeper unconsolidated aquifer composed of stratified glacial materials is present at greater depth beneath both plants. Although not utilized by consumers proximate to the plants, this aquifer has the greatest development potential in the study area. Overlying units may recharge this aquifer.
- A deep bedrock aquifer exists in the study area, but is not exploited in the vicinity of the plants, therefore, little is known of its characteristics.
- Both plants and nearby communities obtain water resources from municipal water distribution systems.
- Shallow aquifer contamination has been identified at Plant 29 and is the subject of a continuing remediation program.
- Flooding is not known to be a problem typical of the study area.
- No threatened or endangered species are known to exist in the study area.

From these major points, it may be seen that potential pathways for the migration of hazardous waste-related contamination exist. If haz-

ardous materials are present in or on the ground, they may encounter a shallow aquifer and subsequently be discharged to area surface waters. The potential for the migration of contamination to the major regional aquifer is considered to be remote.

SECTION 4

FINDINGS

This chapter summarizes the hazardous wastes that have been generated on Air Force Plant Nos. 28 and 29, describes past waste management and disposal methods, identifies the disposal sites located at each of the plants, and evlauates the potential for environmental contamination from those sites. For each discussion section, AFP No. 28 is presented first followed by AFP No. 29.

PAST SHOP AND PLANT ACTIVITY REVIEW

A review was conducted of current and past waste generation and management methods in order to identify those activities that resulted in the generation of hazardous waste. This activity consisted of a review of files and records, interviews with current and former plant employees, and site inspections.

The sources of hazardous waste at Air Force Plant Nos. 28 and 29 can be associated with one of the following activities.

- o Industrial Operations (shops)
- o Fuels Management
- o Waste Storage
- o Spills and Leaks
- o Incineration (AFP No. 28 only)

The subsequent discussion addresses only those wastes generated at Air Force Plants Nos. 28 and 29 which are either hazardous or potentially hazardous. A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material. Potentially hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this report, is defined by, but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Waste petroleum products such as

contaminated fuels, waste oils and waste solvents are also included in the "hazardous waste" category.

The same approach was used at both Air Force plants Nos. 28 and 29 to collect information concerning past industrial activities. The wastes generated from the present industrial operations were used as a starting point for defining the past waste generation and waste management practices at the plant sites. There were no shop files maintained to identify waste generation by unit operation. Therefore, the department operations were reviewed with company employees familiar with the operations. From this review a list was developed that contains the department name and number, the location, hazardous material handlers, hazardous waste generators, and typical treatment, storage, and disposal methods. This list appears in Appendix D.

Those shops which were determined to be generators of hazardous waste were selected for further investigation and evaluation. During the site visit, interviews were conducted with personnel specifically familiar with these shop operations and waste generation. These interviews focused on hazardous waste generation, waste quantities, and methods of storage, treatment, and disposal of hazardous waste. Manifest records were also used to define present waste generation and management practices. Historical information was obtained primarily from interviews with various employees. Tables 4.1 and 4.2 summarizes the information obtained from the detailed shop reviews including information on shop location, identification of hazardous or potentially hazardous wastes, present waste quantities, and waste management time lines for AFP Nos. 28 and 29, respectively. Changes in the waste management methods are noted on the table.

AFP No. 28 Industrial Operations (Shops)

Industrial operations at Air Force Plant No. 28 have been conducted by the General Electric Company since the plant began operations in 1941. The production of aircraft super chargers was the plants primary manufacturing operation during the 1940's. The assembly of jet engines, has been the plants function since the late 1940's. The industrial activities performed at the plant, with the exception of the heat treatment and test cell operations which were added in the 1950's, have remained the same.

TABLE 4.1

AIR FORCE NO. PLANT NO. 28

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	PRESENT WASTE QUANTITY	METHOD(S) OF WASTE MANAGEMENT 1940 1950 1960 1970 1980
ZYGLO INSPECTION	B 20	SPENT PENETRANT	50 GALS./MO.	SANITARY SEWER 1970–1981; OFF SITE CONTRACTOR 1981–
GARAGE MAINTENANCE	B 3	WASTE OILS	50 GALS./YR.	TO OIL HOUSE 1941–
GRINDING ROOM	B 1	LUBRICATING, CUTTING OILS	50 GALS./YR.	TO OIL HOUSE
HEAT TREATMENT	B 8	LUBRICATING, CUTTING OILS	50 GALS./YR.	TO OIL HOUSE 1958–
LABORATORY	B-1	LABORATORY CHEMICALS	25 GALS./YR.	OFF-SITE CONTRACTOR 1941–1970 (estimated), 1970–
OIL HOUSE	B 9	WASTE OILS	10,000 GALS./YR. (PAST) 67,000 GALS./YR. (PRES.)	OFF-SITE CONTRACTOR
PUNCH PRESS	B 1	WASTE OIL LUBRICATING (COMBINED WITH OTHER WASTE OIL)	COMBINED WITH OTHER WASTE OIL	TO OIL HOUSE
RING ROLL	B 1	DRYING OIL	400 GALS./YR.	TO OIL HOUSE 1977–
SHIPPING	B 12	ISOCYANATE FOAM (FOAM IN PLACE PROCESS)	165 GALS./YR.	OFF SITE CONTRACTOR 1981–
TOOL & DIE	B 1	WASTE OIL	2000 GALS./YR.	TO OIL HOUSE 1942–
X RAY	B 22	X RAY FILM, DEVELOPER FIXER	1000 LBS./YR.	SILVER RECOVERY THEN TO SANITARY SEWER 1960's–

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.2

AIR FORCE PLANT NO. 29

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	PRESENT WASTE QUANTITY	METHOD(S) OF WASTE MANAGEMENT 1950 1960 1970 1980
AIR COMPRESSOR STATION	29 A	WASTE OIL AND FUEL	20 GALS./WK.	1944 OIL WATER SEPARATOR 1974 GE FOR RECOVERY
ASSEMBLE (DEVELOPMENT)	29	WASTE OIL AND FUEL	1 GAL./WK.	OFF-SITE CONTRACTOR 1968 GE INCINERATOR 1972 OFF-SITE CONTRACTOR 1974 GE FOR RECOVERY
TEST CELL NO. 1	29	WASTE FUEL	10 GALS./WK.	1958 OFF-SITE CONTRACTOR GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST CELL NO. 2	29	WASTE FUEL	10 GALS./WK.	OFF-SITE CONTRACTOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29 N
TEST CELL NO. 3	29	WASTE FUEL	10 GALS./WK.	OFF-SITE CONTRACTOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29 N
TEST CELL NO. 4	29	WASTE FUEL	10 GALS./WK.	OFF-SITE CONTRACTOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST CELL NO. 5	29	WASTE FUEL	10 GALS./WK.	OFF-SITE CONTRACTOR 1966 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29 N
TEST CELL NO. 6	29	WASTE FUEL	10 GALS./WK.	OFF SITE CONTRACTOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29 N
TEST CELL NO. 106	29 A	WASTE FUEL	10 GALS./WK.	1944 OIL WATER SEPARATOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29 N

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

TABLE 4.2 (cont'd)

AIR FORCE PLANT NO. 29

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	PRESENT WASTE QUANTITY	METHOD(S) OF WASTE MANAGEMENT (1950 1960 1970 1980)
TEST CELL NO. 107	29 A	WASTE FUEL	10 GALS./WK.	1944 OIL WATER SEPARATOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST CELL NO. 108	29 A	WASTE FUEL	10 GALS./WK.	OIL WATER SEPARATOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST CELL NO. 109	29 E	WASTE FUEL	10 GALS./WK.	1945 OIL WATER SEPARATOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST CELL NO. 110	29 R	WASTE FUEL	10 GALS./WK.	1956 OIL WATER SEPARATOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST CELL NO. 111	29 R	WASTE FUEL	10 GALS./WK.	OIL WATER SEPARATOR 1974 GE FOR RECOVERY
		WASTE OIL	10 GALS./WK.	OIL WATER SEPARATOR 1976 TO BLDG. 29-N
TEST PRODUCTION (TEST CELLS 101, 102, 103, 104 and 105	29	WASTE OIL AND FUEL	250 GALS./MO.	1944 OIL WATER SEPARATOR 1976 TO BLDG. 29-N
DEVELOPMENT ASSEMBLE	29	WASTE OIL AND FUEL	1 GAL./WK.	1975 GE FOR RECOVERY
ENGINE QUALITY	29	WASTE OIL	2 GALS./WK.	OIL WATER SEPARATOR 1974 GE FOR RECOVERY
TEST MECHANICS	29	FREON	1 GAL./MO.	OIL WATER SEPARATOR GE FOR RECOVERY
VAPOR DEGREASER	29	SPENT SOLVENT	50 GALS./MO.	1941 OFF SITE CONTRACTOR 1960 OFF SITE CONTRACTOR 1983

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.2 (cont'd)
AIR FORCE PLANT NO. 29

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF WASTE MANAGEMENT (1950 1960 1970 1980)
PARTS CLEANING	29	VARSOL	10 GALS./WK.	1941 OFF SITE CONTRACTOR 1960 GE FOR RECOVERY
FUELS STORAGE	TANK FARM	FUEL SLUDGE	500 GALS./YR.	1952 OFF-SITE CONTRACTOR
GRINDING	29	SPENT ELECTROLYTE COOLANT	20 GALS./MO.	1974 GE FOR RECOVERY

KEY
——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL
- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

The primary wastes generated at the plant are waste oils and spent coolant. These materials are typically either stored in underground tanks (waste oil) or drummed prior to being contract hauled off-site for disposal or reclamation. There are six storage areas on the plant site. Several of the industrial wastes that are presently disposed of off-site were previously discharged to either the waste sump located in the main manufacturing building or the sanitary sewer system.

AFP No. 28 Fuels Management

The fuels management system at AFP No. 28 initially consisted of nine underground storage tanks having a total tankage of 167,000 gallons. The tankage, tank contents, location on site, placement above or below ground and years of service for each tank is listed in Table 4.3. The location of the fuel tanks on the plant site are shown in Figure 4.1. Storage tanks are supplied by trucks which unload directly to the tanks. Fuel oil from the 100,000-gallon storage tank located underneath the cooling towers are pumped through an underground concrete conduit to three 96,000-Btu boilers used for steam generation in the main manufacturing building. Varsol, cutting oil and lubricants stored in the bulk storage area adjacent to Building No. 12 are pumped through another underground conduit to the oil house for distribution in the manufacturing building.

When the plant was originally constructed, five 10,000-gallon underground storage tanks made up the bulk storage area next to Building No. 12. The bulk storage tanks were in use until the mid-1970's. In the late 1970's when additional bulk storage was required the tanks were recommissioned. As a result of a discrepancy in the fuel inventory that occurred in 1979, the fuel tanks were pumped out and pressure tested by an outside contractor. The tanks were found to leak and subsequently were removed from service (for further discussion see subsection on spills and leaks). In 1980, three above ground 5,000-gallon storage tanks were installed above the abandoned tanks. The present bulk storage tankage of AFP No.28 is 132,000 gallons. All of the plant's storage tanks are inspected daily by gauging for inventory control for underground tanks and visual inspection for above ground tanks.

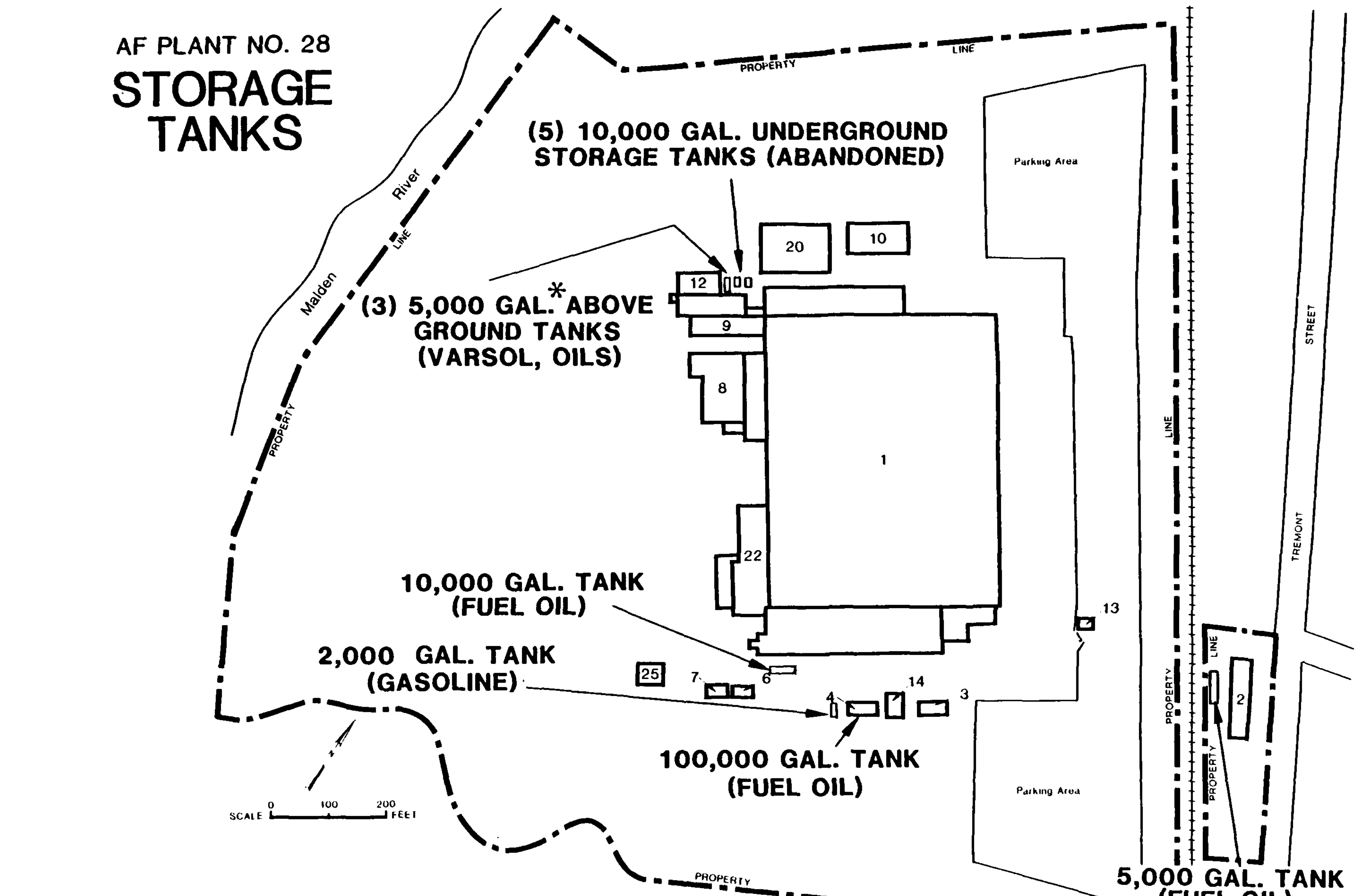
TABLE 4.3

STORAGE TANKS
AFP NO. 28

Tankage (gallons)	No. of Tanks	Tank Contents	Location On Site	Placement Above or Below Ground	Years In Service
100,000	1	#6 Fuel Oil	Underneath Cooling Tower	Below Ground	1941 - Present
10,000	1	#2 Fuel Oil	SW Corner of the Main Manufacturing Bldg.	Below Ground	1941 - Present
10,000	5	Varsol; Lubricating & Cutting Oils	Adjacent to the East Wall of Building No. 12	Below Ground	1941 - 1979 (abandoned)
2,000	1	Gasoline No. 14	Adjacent to Building	Below Ground	1941 - Present
5,000	1	#2 Fuel Oil	Behind Administration Building No. 2	Below Ground	1941 - Present
5,000	1	DTE-24 Lubricating Oil	Adjacent to the East Wall of Building No. 12	Above Ground	1980 - Present
5,000	1	Varsol	Adjacent to the East Wall of Building No. 12	Above Ground	1980 - Present
5,000	1	Cutting and Lubricating Oil	Adjacent to the East Wall of Building No. 12	Above Ground	1980 - Present

SOURCE: Plant Documents

AF PLANT NO. 28 STORAGE TANKS



SOURCE: PLANT DOCUMENTS

* ABOVE GROUND TANKS ARE LOCATED IN A DIKED-IN AREA DIRECTLY OVER THE SITE OF THE ABANDONED STORAGE TANKS.

AFP No. 28 Waste Storage

The storage of wastes at AFP No. 28 occurs at six locations, as described in Table 4.4. Figure 4.2 shows the location of each storage site.

The hazardous waste storage area is located southwest of the main manufacturing building behind Storage Buildings No. 6 and 7. Prior to the construction of the hazardous waste storage area in 1982, all hazardous wastes were stored with the raw materials in Parking Area No. 4. The storage area is an open-air site with waste drums placed on wooden pallets and stored on an asphalt base. The area is enclosed with a three-foot high chain-link fence, has four-inch asphalt curbs for spill control and is posted as a hazardous waste storage area. Degreasing solvents (1,1,1-trichloroethane still bottoms) and ring rolling lubricants (Magna Draw 40) are the primary hazardous wastes held in the storage area prior to being removed off-site by a contract hauler for recycling and disposal, respectively. The hazardous wastes are held for less than 90 days prior to being transported. No leaks or spills have been reported at this site and there was no evidence of leaks or spills observed.

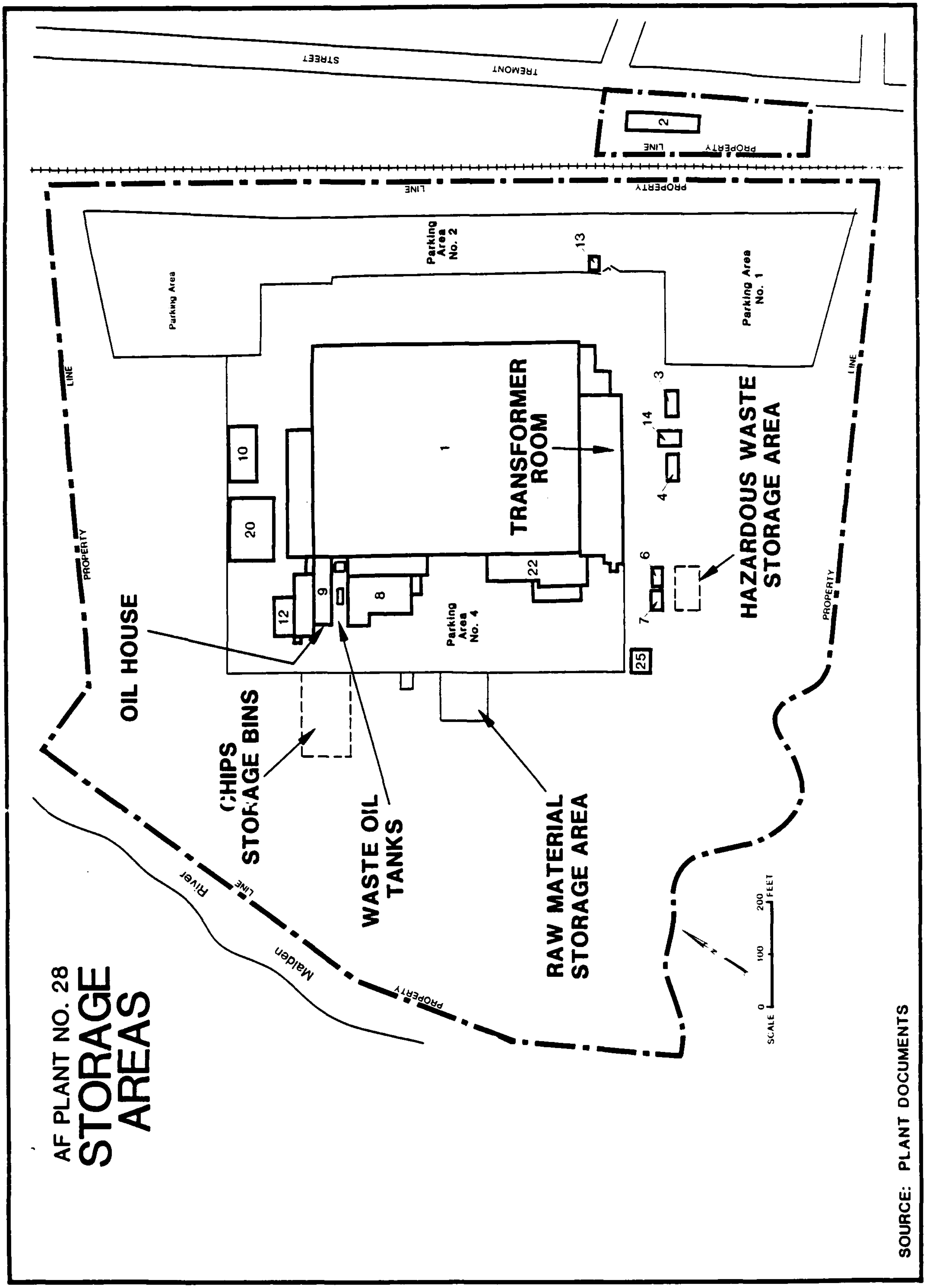
The raw material storage area is located in the area designated as Parking Area No. 4 which is adjacent to the hydrogen pad and west of the main manufacturing building (Figure 4.2). Drums containing acids, alkalis and solvents are stored in this area prior to use in industrial processes. All drums in this area are placed on wooden pallets and stored in the open-air area. Drums are segregated and stored according to their contents. No leaks or spills have been recorded in this area and no evidence was observed to indicate that spills have occurred.

The oil house is in Building No. 9 which is adjacent to the northwest corner of the main manufacturing building. The oil house is the distribution center for petroleum-based products such as varsol, DTE lubricating oil and cutting oil that are piped in from the bulk storage tanks. Drummed coolants and lubricants are also supplied from this location. Process chemicals and solvents are not distributed from the oil house but are distributed directly from the virgin material storage area to the process lines. The oil house is also the site for disposal of oils, coolants and lubricants that are collected by the sump suckers

TABLE 4.4
SUMMARY OF STORAGE AREAS
AFP No. 28

Storage Area	Materials Stored	Capacity	Period of Operation
Hazardous Waste Storage Area	Degreasing Solvents, Lubricants (Magna Draw 40)	75 Drums	1982 - Present
Raw Material Storage	Process Chemicals	100 Drums	1942 - Present
Oil House	Oils & Lubricants	45 Drums	1942 - Present
Transformer Room	PCB Transformers, Capacitors and Oils	--	1942 - Present
Waste Oil Tanks	Waste Oil, Machine Coolants and Lubricants	5,000 Gallons	1942 - Present
Chip Storage Bins	Metal Chips from Machining Operations	--	1942 - Present

SOURCE: Plant Documents



AF PLANT NO. 28
STORAGE AREAS

SOURCE: PLANT DOCUMENTS

for disposal to the waste oil tanks. The oil house has been in this location since the plant was first constructed. Spills which occur in this area flow to the oil house floor drains which are piped directly to the waste oil tank.

The PCB Storage area is located in the transformer room of the main manufacturing building. Prior to off-site disposal, PCB transformers removed from service and waste PCB oils and capacitors are stored in this area. In the past, the transformer room was also used for this purpose. The transformer room is kept locked and is posted as a restricted area. No reports of any significant spills in this area have been recorded.

The original 5,000-gallon waste oil tank was placed in operation when the plant was constructed in 1941. The tank was installed partially underground and is located between Building Nos. 8 and 9 at the northwest corner of the manufacturing building. The waste tank was taken out of service in 1980 after pressure testing indicated that the tank had a leak. A new 5,000-gallon underground storage tank was installed in 1980. The present tank is piped directly to the disposal drains located in the oil house as was the abandoned tank. The wastes stored in the tank includes waste oil, machine coolants and lubricants collected by the sump suckers from all plant operations. The stored wastes are transported off-site approximately every two weeks by a contract hauler to the waste oil treatment facility at the GE Lynn River Works facility. The accumulated oil sludge removed during the annual clean-out of the waste oil tank requires off-site contract disposal.

The metal chips from the plant machining operations have been stored in virtually the same location since the plant began operations. The storage site is located west of Building No. 9 and north of the raw material storage area. Prior to 1973, the chip storage area was located further west then it is today. In the past, the chips were not segregated and were piled on the ground resulting in lubricating oils draining onto the surface soils. In 1973, segregated storage bins were constructed on a concrete pad with a drainage collection system connected to an underground oil/water separator. The separated oil is disposed of off-site by a contract hauler approximately every six months. The metal chips are recycled to a metallurgical reclaimer as needed.

AFP No. 28 Spills and Leaks

Chemical spills and leaks have occurred in several areas of AFP No. 28 and are depicted in Figure 4.3. In Table 4.5, the materials, quantities, locations and clean-up method for each spill and leak identified from this study are presented. Spills typically have occurred in the heat treatment and pickle line areas whereas leaks have been attributed to underground storage tanks.

A large spill of an estimated 700 gallons of 20-30% sodium hydroxide occurred in the old pickle line area in 1982. The spill resulted from a defective seam in a fiberglass tank and the tank's contents were discharged to the concrete basin below. The waste was contained within the basin, diluted with water and disposed of off-site by a contract hauler. Also in 1982, an estimated 1,000 gallons of No. 6 fuel oil from the 100,000-gallon bulk fuel oil tank was discharged to the pipe conduit which connects the fuel tank with the manufacturing building. The fuel oil was contained within the conduit structure and recovered by an off-site contractor.

Several minor spills have occurred in the heat treatment area in the past. Typically, the spills are small and are contained within the immediate area, diluted with copious amounts of water and discharged to the sanitary sewer. In 1979, an estimated 20 gallons of hydrofluoric and nitric acid solution were spilled and the procedures described above were followed.

A fire in the metal treatment area in 1978 resulted in the rupturing of polyethylene and metal process tanks containing plating solutions. The released solutions were partially consumed in the intense fire and the rest was flushed to the sanitary sewer with the water used to put out the fire. No potential for contamination to the environment was known to have occurred in the spills described above.

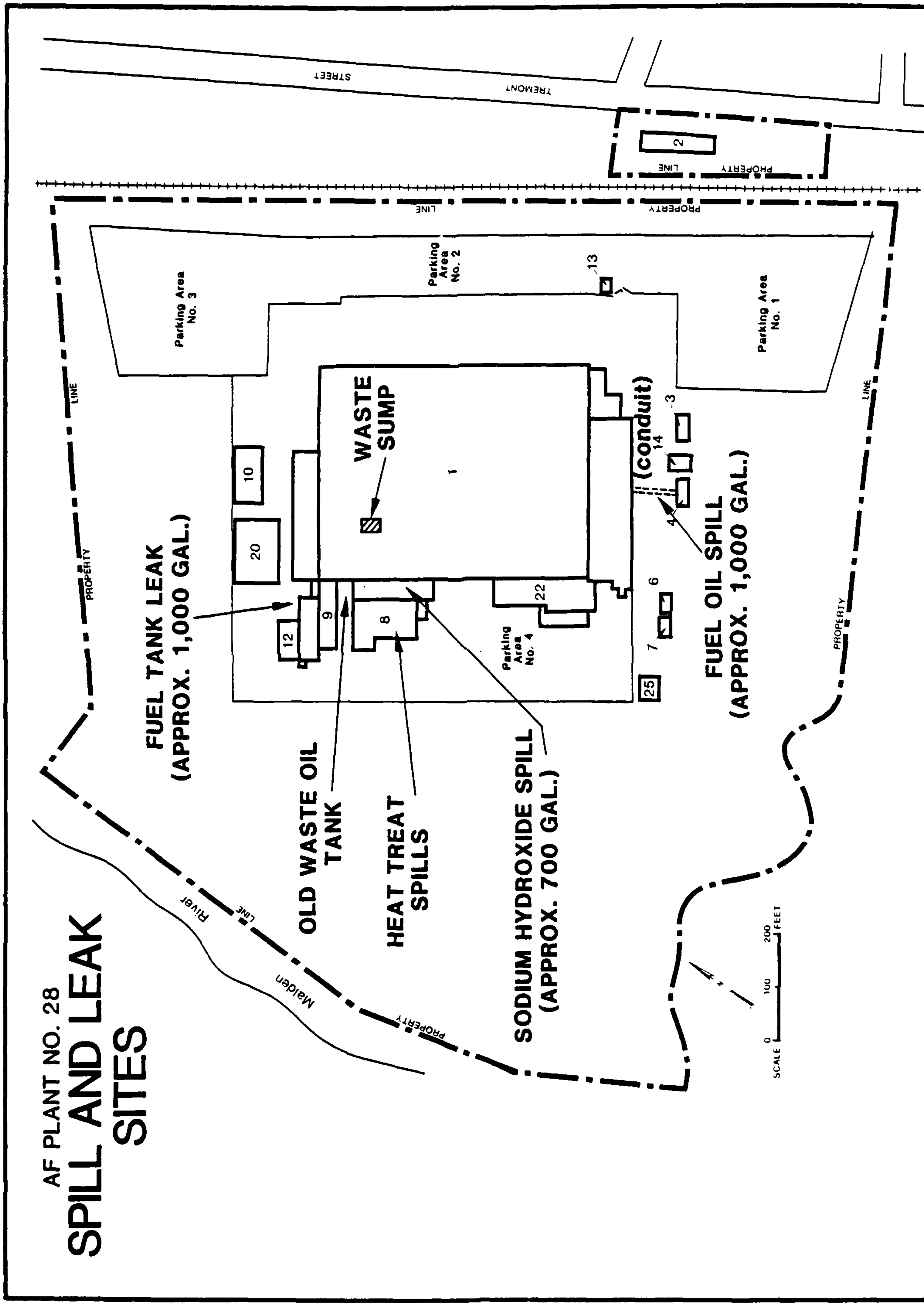
Several of the five 5,000-gallon bulk storage tanks located adjacent to Building No. 12 were found to leak during pressure testing performed on the tanks in 1979. An estimated 1,000 gallons of hydraulic fluid was suspected of being lost from one of the tanks prior to the testing effort.

The original 5,000-gallon waste oil tank that was installed in 1941 and is located between Building Nos. 8 and 9 was taken out of service in

TABLE 4.5
SPILLS AND LEAKS
AFP No. 28

Year	Material	Quantity (Spill, Leak or Discharge)	Location	Clean-up and Disposal
1982	20-30% Sodium Hydroxide	300 Gal (est.) (Spill)	pickle line area (old)	diluted with water and contract hauled off-site
1982	No. 6 Fuel Oil	1,000 Gal (est.) (Spill)	pipe conduit from the 100,000 Gal bulk fuel	contained and recovered by an off-site contractor
1979	Hydrofluoric and nitric acid solution	20 Gal (est.) (Spill)	heat treat area	diluted with water and discharged to the sanitary sewer
1978	Plating Solution	Unknown (Spill)	heat treatment area	diluted water and discharge to the sanitary sewer
1979	Hydraulic Fluid	1,000 Gal (est.) (Leak)	(5) 5,000 Gal bulk storage tanks located adjacent to Building No. 12	Contamination assessment study
1980	Waste Oil	Unknown (Leak)	5,000 Gal waste oil tank between Buildings Nos. 8 and 9	Contamination assessment study
1943-1975	Coolants and Light Lubricating Oils	Unknown (Discharge)	Underground waste sump location adjacent to the ring roll, area	Contamination assessment study

SOURCE: Plant documents


AF PLANT NO. 28
SPILL AND LEAK SITES
TREMONT STREET
PROPERTY LINE
Parking Area No. 1
Parking Area No. 2
Parking Area No. 3
Parking Area No. 4
WASTE SUMP
(conduit)
FUEL OIL SPILL (APPROX. 1,000 GAL.)
FUEL TANK LEAK (APPROX. 1,000 GAL.)
OLD WASTE OIL TANK
HEAT TREAT SPILLS
SODIUM HYDROXIDE SPILL (APPROX. 700 GAL.)
Malden River
1
2
3
4
6
7
8
9
10
12
13
14
20
22
25
SCALE 0 100 200 FEET

1980 after pressure testing indicated that the tank was leaking. The volume of waste oil released from the tank is unknown.

A contamination assessment study was performed by independent contractors in 1980 and 1983. Several test wells were placed approximately 25 to 50 feet due north of the bulk storage area and 125 feet west of the waste oil storage area. The test wells were pumped over a three-month period and no detectable amount of oil or hydraulic fluid was recovered.

Prior to 1979, all water-based coolants collected from plant machinery by sump suckers were disposed of to an underground sump located adjacent to the ring rolling area in the main manufacturing building. According to plant personnel, coolants mixed with oil and light lubricating oils were disposed of at this site as well. Specifications of the underground sump were not available on the plant's original site plans; however, interviews with plant personnel indicated that the underground sump had a capacity of approximately 9,000 gallons. The sump was capped in 1979 to prevent further use. The inlet to the sump is located in the same general vicinity of the manufacturing building as the leaking bulk storage tanks and waste oil tanks.

AFP No. 29 Industrial Operations (Shops)

Industrial operations at Air Force Plant No. 29 have been conducted by the General Electric Company since the plant began operations in 1943. The plant operated as a super charger test and assembly plant during World War II. In the late 1940's the assembly and testing of jet engines was the plants primary function. The plants industrial operations have remained the same however, the plant underwent several expansions during the 1950's and 1960's including the addition of engine test cells and storage areas.

The primary wastes from AFP No. 29 are waste oils and contaminated fuels. Most of the waste oil is collected in tanks or in the oily water collection system, and the oil is removed for disposal or recovery at an off-site location. The contaminated fuel is collected and processed in the GE plant for recovery of fuel. Other wastes are drummed for off-site disposal or discharged to the sanitary sewer. None of the wastes generated, with the exception of waste oil, are stored on the plant site. Several of the industrial wastes that are now disposed of off-

site were previously discharged into the sanitary sewer system or the surface drainage system (following oil water separators).

AFP No. 29 Fuels Management

The fuels management system at AFP No. 29 originally consisted of an underground distribution system and 11 underground storage tanks with a combined tankage of 132,000 gallons (Table 4.6). The location of the fuel oil tanks on AFP No. 29 are depicted in Figure 4.4. With the exception of four tanks used to store lubricating oils and calibration fluid, the tanks were used to store jet propellents. During a period of expansion in the late 1950's, a bulk fuel farm consisting of three 156,000 gallon tanks were added. These tanks were also used to store jet propellents. Fuel shipments have always been delivered by barge up the Sauges River with the exception of smaller specialty fuel shipments which are brought in by tanker trucks. From 1943 to approximately 1976, fuels were distributed from the bulk storage tanks by both the underground pipe system and tanker trucks.

A fuel line and tank storage leak testing program was initiated in the early 1970's. Every six months, fuel pipe lines were routinely pressure tested and the storage tanks were monitored for leaks. As a result of this testing program, many of the underground fuel distribution pipe lines and a 20,000-gallon bulk storage tank used for the storage of jet propellent were removed from service. Two new underground pipelines were installed in 1976 to distribute fuels from the bulk storage area to the test cells in Building 29-A. An overhead fuel distribution system was constructed between 1976 and 1978 to replace the underground distribution system. However, the underground system is still used when fuel demand exceeds the above ground systems supply capacity. Tank trucks are also used to transport specialty fuels to the underground storage tanks.

AFP No. 29 PCB Transformers

Six PCB transformer substations are located on the AFP No. 29 property. A thorough inspection of the transformers located on the plant site is performed on a six-month schedule. A visual inspection of the transformers is also conducted on a monthly basis. No storage of PCB wastes occurs on the AFP No.29 property. There are no reports which

TABLE 4.6

FUEL STORAGE TANKS
AFP No. 29

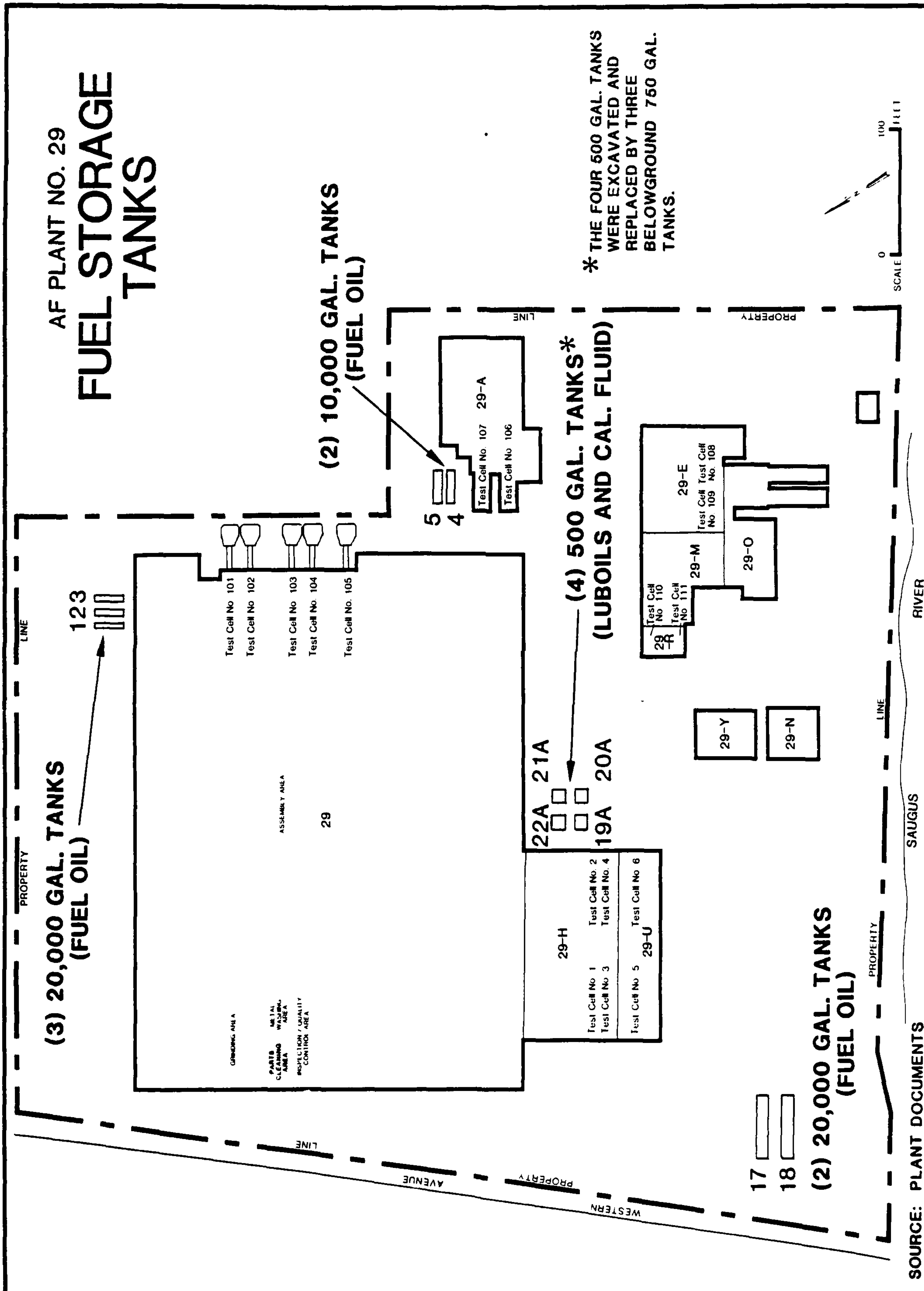
Tank No.	Tankage (gallons)	Tank Contents	Underground or Surface	Tank Location	Years of Service
--	156,000	JP-4	Surface	Bulk Storage Farm	1950's - Present
--	156,000	JP-4	Surface	Bulk Storage Farm	1950's - Present
--	156,000	JP-5	Surface	Bulk Storage Farm	1950's - Present
1	20,000	JP-4	Underground	SE Corner of Building 29 Proper	1943 - Present
2	20,000	JP-4	Underground	SE Corner of Building 29 Proper	1943 - Present
3	20,000	JP-4	Underground	SE Corner of Building 29 Proper	1943 - 1970's
4	10,000	JP-4	Underground	SW Corner of Building 29 Proper	1943 - Present
5	10,000	JP-4	Underground	SW Corner of Building 29 Proper	1943 - Present
17	25,000	JP-4	Underground	Adjacent to the NE Corner of Building 29-U	1943 - Present

TABLE 4.6 (Continued)

FUEL STORAGE TANKS
AFP No. 29

Tank No.	Tankage (gallons)	Tank Contents	Underground or Surface	Tank Location	Years of Service
18	25,000	JP-4	Underground	Adjacent to the NE Corner of Building 29-U	1943 - Present
19A	500	Lubricating Oil	Underground	South of Building 29-H	1943 - 1983 (abandoned)
20A	500	Lubricating Oil	Underground	South of Building 29-H	1943 - 1983 (abandoned)
21A	500	Lubricating Oil	Underground	South of Building 29-H	1943 - 1983 (abandoned)
22A	500	Calibration Fluid	Underground	South of Building 29-H	1943 - 1983 (abandoned)
--	750	Lubricating Oil	Surface	South of Building 29-H	1983 - Present
--	750	Lubricating Oil	Surface	South of Building 29-H	1983 - Present
--	750	Calibration Fluid	Surface	South of Building 29-H	1983 - Present

SOURCE: Plant Documents



SOURCE: PLANT DOCUMENTS

indicate that PCB's have been released to the environment from the transformers located on the plant site.

AFP No. 29 Spills and Leaks

Several minor fuel spills have occurred in areas of the AFP No. 29 as a result of overfilling tanks and the transferring of fuels. These fuel spills are usually small in volume and occur within spill containment dikes or on paved areas. The spills are immediately cleaned up without significant environmental contamination occurring.

Two major spills have occurred at AFP No. 29 (Figure 4.5). In 1975, an estimated 20,000 gallons of JP-4 was discharged from a broken fuel supply pipe in the area behind Building 29-E (Table 4.7). The spilled fuel flowed across the paved area between Buildings 29-E and the property boundary and entered into a catch basin connected to the surface drainage system. At the time of the incident, the Saugus River was at high tide which prevented the fuel from being discharged from Outfall No. 9. An estimated 2-3 thousand gallons of fuel was recovered prior to low tide when the fuel within the storm sewer pipe flowed into the Saugus River. Following the incident, a site above Outfall No. 9 and directly over the surface drainage pipe was excavated. The excavation determined that some of the fuel contained within the storm sewer pipe during high tide had leaked into the surrounding subsurface soils. As a result, several test wells were placed in the vicinity of the excavation. These test wells were pumped continuously for several months and additional fuel was recovered, but the exact amount is unknown. The test wells were again pumped during the two summers following the spill incident. No detectable amount of fuel was recovered.

A spill of 2,500 gallons of JP-4 occurred in the bulk fuel farm in 1983 (Figure 4.5). The spill took place on a paved area outside of the spill containment dikes. Immediate spill containment actions were taken and the fuel was recovered. Due to the nature of the spill and its location, no significant environmental contamination is attributed to this incident.

Many leaks in the underground fuel distribution system have occurred at AFP No. 29. Most of the underground fuel lines with the exception of those installed in 1976 (between the bulk fuel farm and

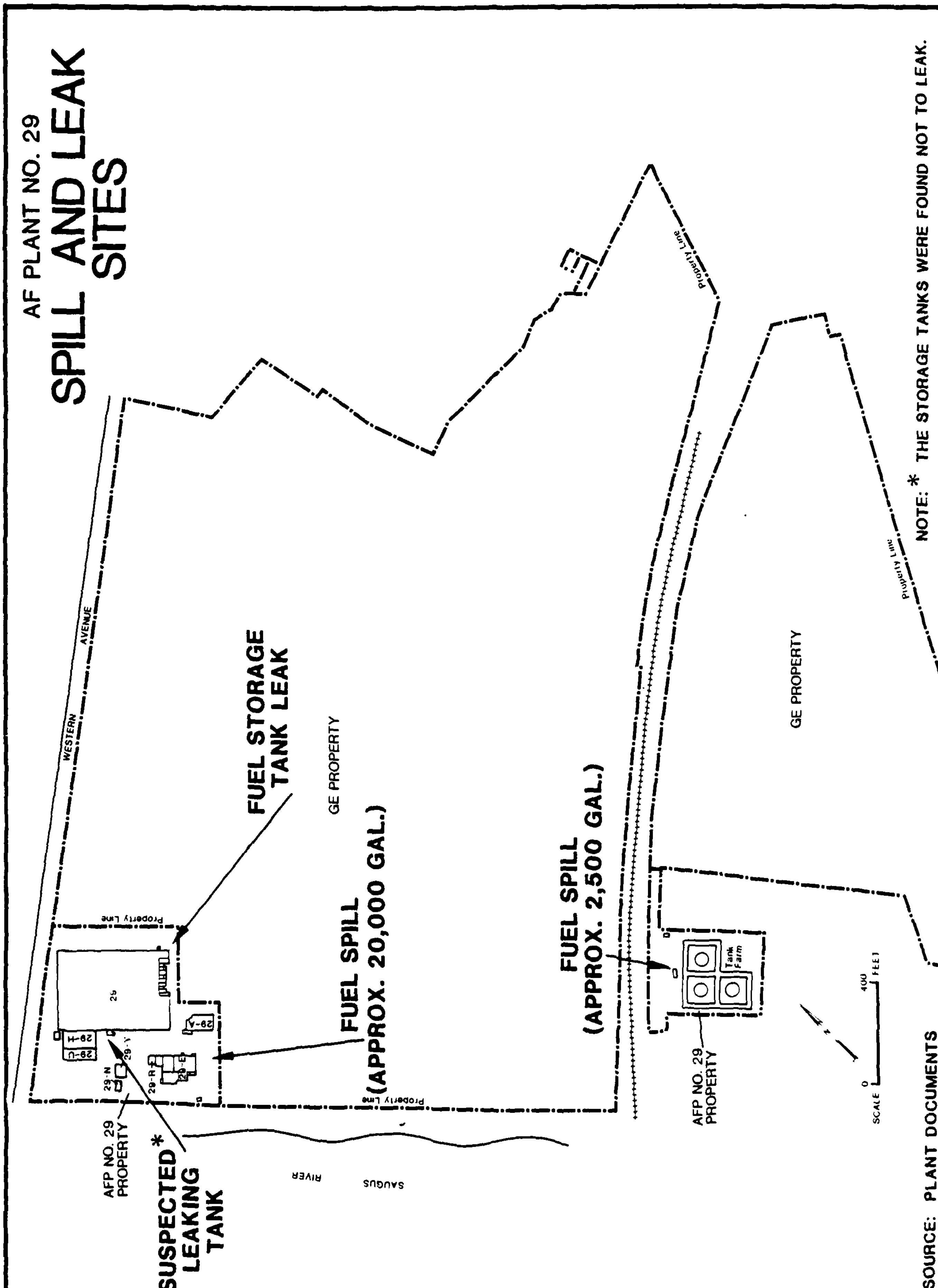

AF PLANT NO. 29
SPILL AND LEAK SITES
FUEL STORAGE TANK LEAK
FUEL SPILL (APPROX. 20,000 GAL.)
FUEL SPILL (APPROX. 2,500 GAL.)
SUSPECTED LEAKING TANK *
AFP NO. 29 PROPERTY
AFP NO. 29 PROPERTY
GE PROPERTY
GE PROPERTY
WESTERN AVENUE
SAUGUS RIVER
Property Line
Tank Farm
29
29-A
29-H
29-U
29-N
29-R
29-E
SCALE 0 400 FEET
NOTE: * THE STORAGE TANKS WERE FOUND NOT TO LEAK.
SOURCE: PLANT DOCUMENTS

TABLE 4.7
SPILLS AND LEAKS
AFP No. 29

Year	Material	Quantity (Spill, or Leak)	Source/Location	Clean-up and Disposal
1975	JP-4	20,000 Gal (est.) (Spill)	broken fuel line behind Building 29-E	partial recovery, discharged to the Saugus River and follow-up recovery efforts
1983	JP-4	2,500 Gal (est.) (Spill)	bulk storage farm - outside spill containment dikes	containment and recovery efforts
1943-	JP-4, JP-5	Unknown (Leaks)	underground fuel distribution system	removal of leaking fuel lines from service
1970's	JP-4	Unknown (Leak)	underground storage tank located at the SE corner of Building No. 29	follow-up assessment study
1983	Lubricating Oils and Calibration Fluids	--	(4) 500 Gal underground storage tanks located south of Building No. 29-H	follow-up assessment study - no contamination detected

SOURCE: Plant Documents

Building 29-A) have been taken out of service since the completion of the overhead fuel distributor system in 1978. The underground pipe testing program that was started in the early 1970's detected leaks within the underground fuel distribution network, but the exact location of the leaks are unknown.

In the early 1970's, a 20,000-gallon JP-4 underground storage tank (Tank No. 3) located at the southeast corner of Building No. 29 was taken out of service after pressure testing indicated the tank was leaking. The tank was cleaned and filled with sand. The quantity of fuel lost is unknown.

As a result of pressure testing, four 500-gallon underground storage tanks located south of Building 29-H were determined to have leaks and taken out of service in 1981. The tanks had been used to store lubricating oils and calibration fluid. The tanks were excavated from the site and replaced by three above ground 750-gallon storage tanks in 1983. During the excavation of the tanks no contamination of the subsurface soils was noted. A test well was placed in the middle of the site where the storage tanks had been located. The well was pumped and no detectable amount of lubricating oil and calibration fluid was found. The excavated tanks were again pressure tested and no leaks were found.

DESCRIPTION OF PAST ON-SITE TREATMENT AND DISPOSAL METHODS

AFP No. 28 Description of Past On-Site Treatment and Disposal Methods

The facilities on Air Force Plant No. 28 which have been used for the treatment and disposal of wastes can be categorized as follows:

- Grit Disposal
- Metal Treatment
- Incinerator
- Sanitary Sewer System
- Surface Drainage System
- Oil/Water Separators

AFP No. 28 Grit Disposal

The grit wastes from the sand blast operations performed at AFP No. 28 were disposed of on site in an area located behind Building No. 25

and adjacent to the hazardous waste storage area (Figure 4.6) The grit wastes were buried approximately five feet underground and covered with soil. The disposal site was used from the 1940's until approximately 1979. The grit wastes are presently disposed of as a solid waste off-site.

AFP No. 28 Metal Treatment

AFP No. 28 generates several waste chemicals from its metal treatment operations located in Building No. 8. Listed in Table 4.8 are the chemicals used, quantities disposed of in 1984 and past and present disposal methods. Prior to 1979, all waste chemicals from the metal treatment area with the exception of the kolene salts, were diluted with copious amounts of water and discharged to the sanitary sewer. The kolene salts are in a solid state at temperatures below 750^{o}F and have always required special handling and disposal. Presently, all waste chemicals from the metal treatment operations are disposed of off-site by a waste contractor.

AFP No 28 Incineration

AFP No. 28 has utilized both landfilling and incineration to dispose of refuse (i.e., paper, wooden pallets, trash) since beginning operations in 1941. During the 1940's and early 1950's plant refuse was disposed of on the property adjacent to the plant site which was then the Everett Public Sanitary Landfill. The landfill was closed in the 1950's and is presently the plant site of AVCO Industries.

In the late 1950's and early 1960's refuse from the plant was burned in an open fire pit. The fire pit was located west of Parking Area No. 4 and southwest of the chip storage bins. Ash from the fire pit was buried on-site in the same general vicinity.

A tepee incinerator replaced the open fire pit for the burning of refuse and operated from approximately 1962 through 1967. The tepee was located southeast of the propellant storage building and was constructed over a concrete pad. The refuse ash was buried on-site in an area adjacent to the incinerator pad.

Between 1967 and 1970, all plant refuse was taken off-site for disposal to a sanitary landfill. In the early 1970's, a dual chamber incinerator was constructed behind the main manufacturing building at

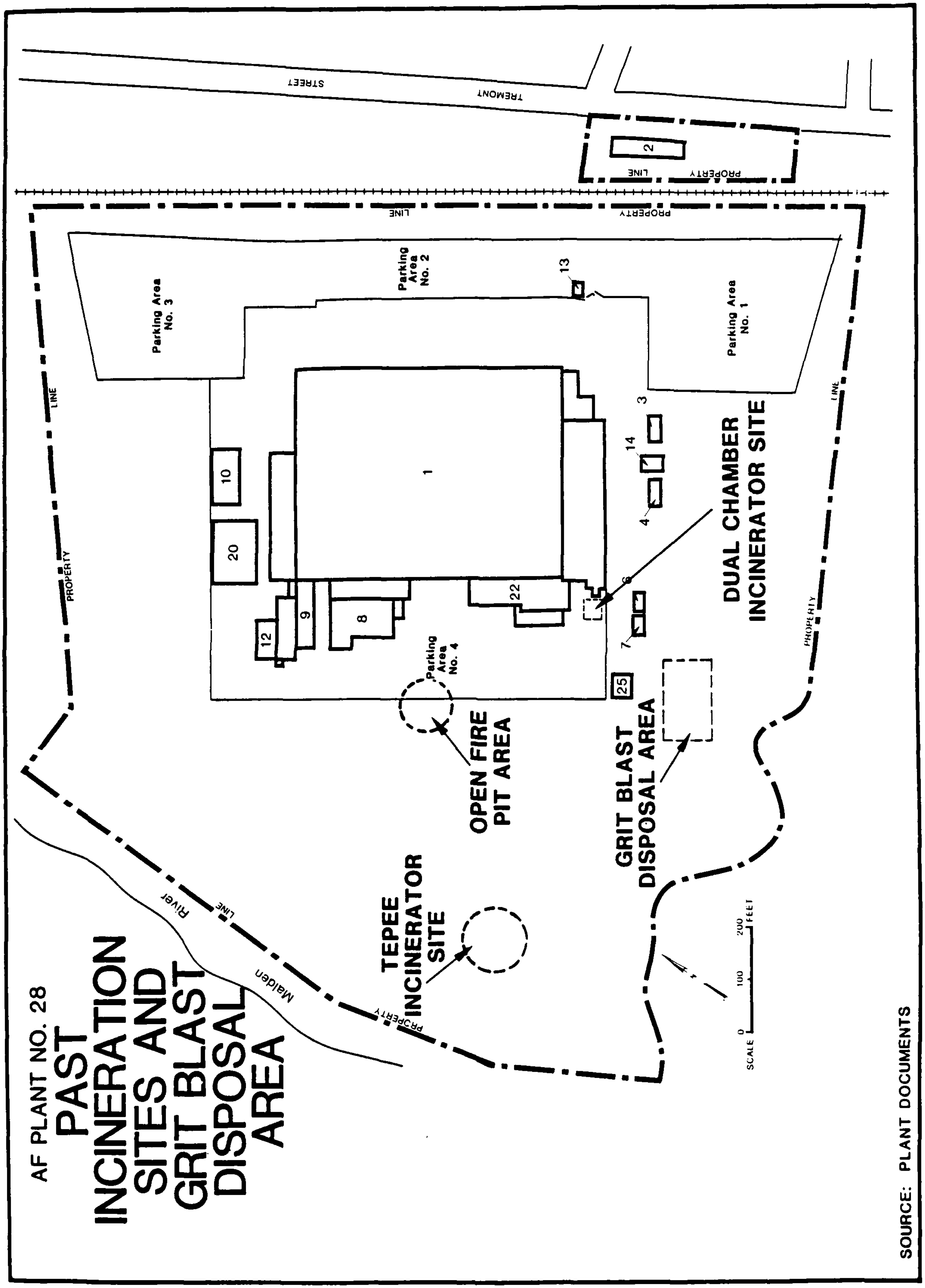

AF PLANT NO. 28
PAST INCINERATION SITES AND GRIT BLAST DISPOSAL AREA
TREMONT STREET
PROPERTY LINE
Parking Area No. 1
Parking Area No. 2
Parking Area No. 3
Parking Area No. 4
DUAL CHAMBER INCINERATOR SITE
OPEN FIRE PIT AREA
GRIT BLAST DISPOSAL AREA
TEPEE INCINERATOR SITE
Malden River
SCALE 0 100 200 FEET
SOURCE: PLANT DOCUMENTS

TABLE 4.8
METAL TREATMENT CHEMICALS
AFP No. 28

Waste Chemical	Commercial Name	Quantity - 1984 (gallons)	Present Disposal Method	Past Disposal Method
Sodium and Potassium Hydroxide Solution	Vitrokleen	6,400	Contract Hauled Off-Site	Diluted and Discharged to the Sanitary Sewer
Kolene Salt	Virgo 500	715	Contract Hauled Off-Site	Contract Hauled Off-Site
Hydrochloric Acid	--	13,188	Contract Hauled Off-Site	Diluted and Discharged to the Sanitary Sewer
Nitric-Hydrofluoric Acid	--	20,740	Contract Hauled Off-Site	Diluted and Discharged to the Sanitary Sewer
Misc. Waste; Acidic and Alkaline Waste	--	340	Contract Hauled Off-Site	Diluted and Discharged to the Sanitary Sewer

SOURCE: Plant documents

the southwest corner of the facility. A number of test burns were performed during the early 1970's. The incinerator was only in use on a full time basis for approximately nine months. The incinerator ash was buried on-site in the same general area that the tepee incinerator wastes were disposed of in the past. Due to both operational problems and high operating costs the incinerator was removed from service in 1973. In 1982, the incinerator was removed from the plant site and was sold as scrap metal.

The ash buried on-site from the incineration of refuse should not pose a threat of environmental contamination since no oils, solvents or other industrial wastes were burned with the refuse. The past on-site incineration sites are depicted in Figure 4.6.

AFP No. 28 Sanitary Sewer System

Sanitary sewage from AFP No. 28 is conveyed to the Deer Island facility which is owned and operated by the Metropolitan District Commission (MDC). No treatment of sanitary wastes occurs at the plant site.

AFP No. 28 Surface Drainage System

Surface water from AFP No. 28 discharges to the Malden River from two outfalls. The plant site surface drainage system consists of two main pipe stems which convey the runoff from all catch basins. Prior to 1973, boiler blowdown water was discharged to the storm collection system which enters the river through Outfall No. 001. This discharge was regulated under the State of Massachusetts NPDES program from 1970 through 1973. The boiler blowdown water was repiped to the sanitary sewer in 1973 and presently only rainwater runoff is conveyed through the system.

The source of the water discharged from the second outfall is from water collected by the pump house located in the western portion of the plant site. The pump house was constructed in the late 1950's to control the water level on the plant site. This outfall is not regulated under the State's NPDES program since only groundwater is discharged to the river.

AFP No. 28 Oil/Water Separators

AFP No. 28 utilizes oil/water separators (OWS) in two locations on the plant site. Since 1973, the chip storage bin has had an underground

OWS to collect the machine oils which drip from the metal chips. After separation the wastewater is discharged directly to the sanitary sewer system. The collected oil is pumped out on a routine basis and disposed of off-site by a contract waste hauler. The wash water from the Cincinnati and Magnus parts washing machines is also pretreated by OWS's prior to being discharged to the sanitary sewer. A sump sucker is used to collect the oil from these small skimmer devices. The waste oil in the sump suckers is pumped out daily to the waste oil tank. Solids that accumulate in the sump suckers are disposed of by an off-site contractor.

AFP No. 29 Description of Past On-Site Treatment and Disposal Methods

The facilities on Air Force Plant No. 29 which have been used for the treatment and disposal of wastes can be categorized as follows:

- o Surface Drainage System
- o Oily Water Collection and Separator System
- o Sanitary Sewer System
- o Septic Leach Fields

Wastes generated in the Group 29 buildings that require disposal include refuse, waste oil and process wastes from the turco, zyglo and electrochemical grinding operations (Table 4.9).

Refuse has always been disposed of off-site of the AFP No. 29 property. The disposal of plant refuse prior to 1971 was to a privately owned landfill that was located across the Saugus River from the plant site. Presently, the plant's refuse is taken to the RESCO incineration facility for disposal.

In addition to the waste oil collection system utilized by the Group 29 Buildings, eleven underground waste storage tanks (Table 4.10) are located throughout the facility for the disposal of waste oils. Cleanouts located in the engine test cells and waste oil funnels that are centrally located in each building are connected to these underground storage tanks (Figure 4.7). The holding tanks are regularly pumped out and the wastes are transported off AFP No. 29 property to the ultrafiltration/centrifugation facility located in the General Electric Plant. These tanks are not routinely leak tested.

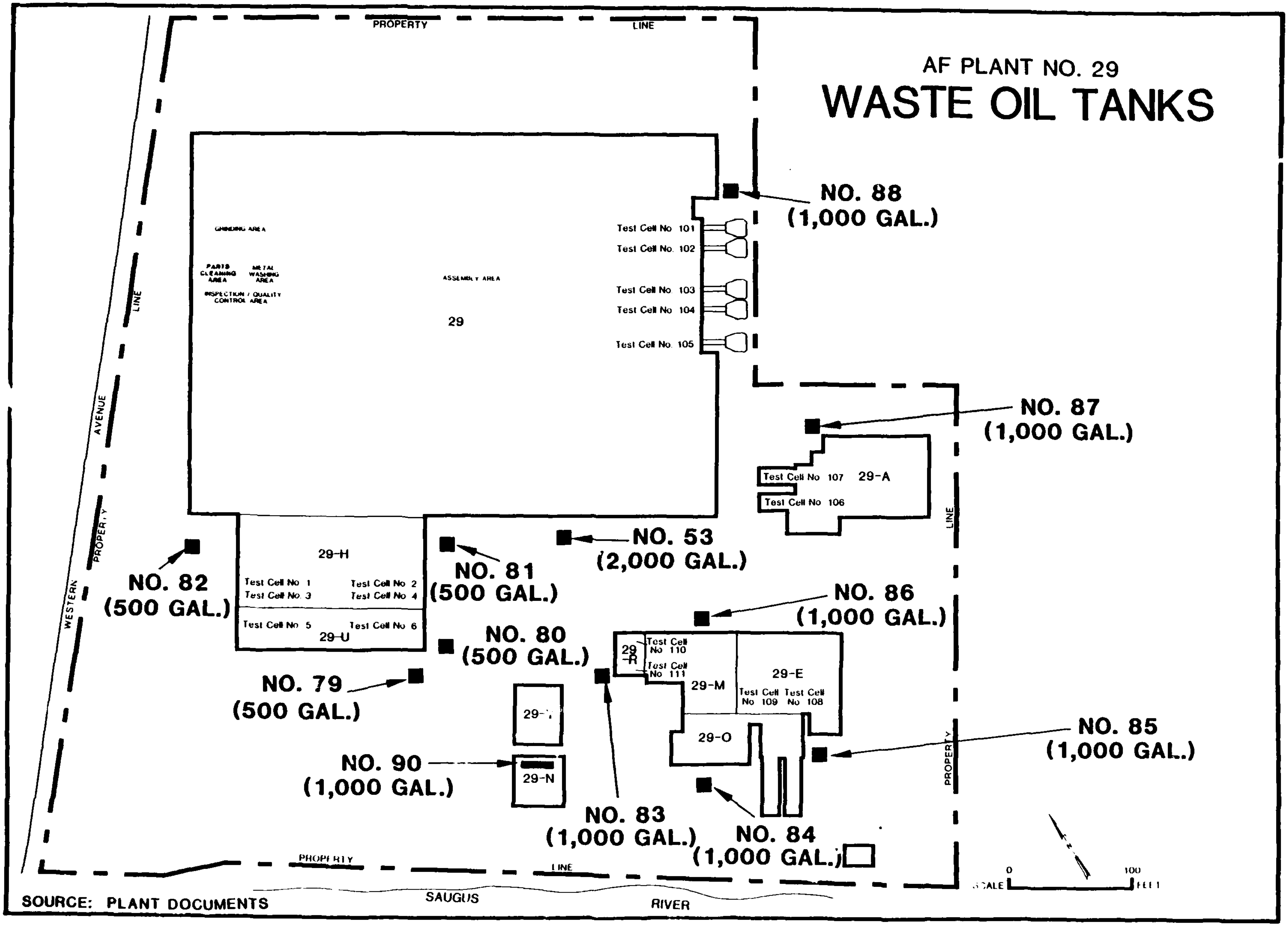
TABLE 4.9

WASTE MANAGEMENT PRACTICES
AFP No. 29

Source of Waste(s)	Waste(s)	Present Disposal Method	Past Disposal Method
Group 29 Buildings	Refuse	Incineration	Sanitary Landfill
Group 29 Buildings	Waste Oil	Heat Recovery Incineration and Off-Site Disposal	Off-Site Disposal
Turco Process Line	Sodium and Potassium Hydroxides	Industrial Waste Treatment - Off-Site Disposal	Discharged to the Sewer System
Zyglo Fracture Test Line	Rinsewater Containing Fluorescence Dyes	Industrial Waste Treatment - Off-Site Disposal	Discharged to the Sewer System
Electrochemical Grinding Operation	Sodium Nitrate, Sodium Formate and Nickle Nitrate	Industrial Waste Treatment - Off-Site Disposal	Industrial Waste Treatment - Off-Site Disposal

SOURCE: Plant Documents

FIGURE 4.7



SOURCE: PLANT DOCUMENTS

The underground waste storage tanks were installed in 1976. Previously, the waste oils from the test cells and plant operations were discharged to the drainage system which feeds Outfalls Nos. 002, 006, 007 and 008. In-line OWS's removed the oils from the waste streams and the water fraction was discharged to the Sauges River. The OWS's were routinely pumped out by a waste hauler for off-site disposal.

Process wastes from the alkaline cleaning, Zyglo and electrochemical grinding operations located in the main assembly building are containerized and transported off of the AFP No. 29 property to General Electric industrial waste treatment plant. Prior to 1970, the process wastes including sodium and potassium hydroxides from the alkaline cleaning line; rinsewater containing flourosceine dyes from the Zyglo line; and sodium nitrate, sodium formate and nickle nitrate from the electrochemical grinding operation were discharged to the sewer system without pretreatment.

AFP No. 29 Surface Drainage System

Outfalls to the Sauges River from AFP No. 29 are listed in Table 4.11 and depicted in Figure 4.8. Active outfalls that convey rainwater runoff include 001, 004, 007 and 009 from the Group 29 Buildings and 032 from the bulk fuel storage area. Non-contact cooling waters from AFP No. 29 flows into a drainage system which feeds to Outfalls 003, 005 and Outfalls 002, 006, 007 and 008 received oily wastewater from engine test cells in the Group 29 Buildings. These outfalls with the exception of Outfall 007 were plugged and their flows were diverted to the underground oil collection system. The oily sewer system is connected to the oil/water separator treatment facility located in Building No. 29-N. The test cell waste streams which were conveyed to Outfall 007 were also diverted to Building 29-N resulting in only surface runoff being discharged from this outfall. Outfalls 001, 003, 005, 007, 009, 010 and 032 are regulated under the State of Massachusetts NPDES program. A detailed description of the drainage system is contained in Chapter 3.

AFP No. 29 Oily Water Collection and Separator System

An underground oily water collection system was installed in 1976 to convey waste oil from the Group 29 Buildings to an automatic oil/water separator system located in Building 29-N. Oily wastewaters from the engine test cells, which were previously conveyed to Outfall Nos.

TABLE 4.10

UNDERGROUND WASTE OIL TANKS

AFP No. 29

Tank No.	Tankage (gallons)	Source of Waste	Location on Site
53	2,000	Shop Carts	West of Building 29 Proper
79	500	Clean Out in Test Cell 6	SW Corner of Building 29-U
80	500	Clean Out in Test Cells 2 and 4	SW Corner of Building 29-U
81	2,000	Clean Outs from Building 29-H	South of Building 29-H
82	500	Clean Outs from Test Cells 1, 3 and 5	North of Building 29-H
83	1,000	Waste Oil Funnels in Test Cells 110 & 111	NW Corner of Building 29-R
84	1,000	Clean Outs and Waste Oil Funnel from Building 29-O	West of Building 29-O
85	1,000	Clean Outs and Waste Oil Funnel from Building 29-E	SW Corner of Building 29-E
86	1,000	Clean Outs and Waste Oil Funnel from Building 29-M	East of Building 29-M
87	1,000	--	NE Corner of Building 29-A
88	1,000	--	South of Building 29 Proper
90	1,000		

SOURCE: Plant Documents

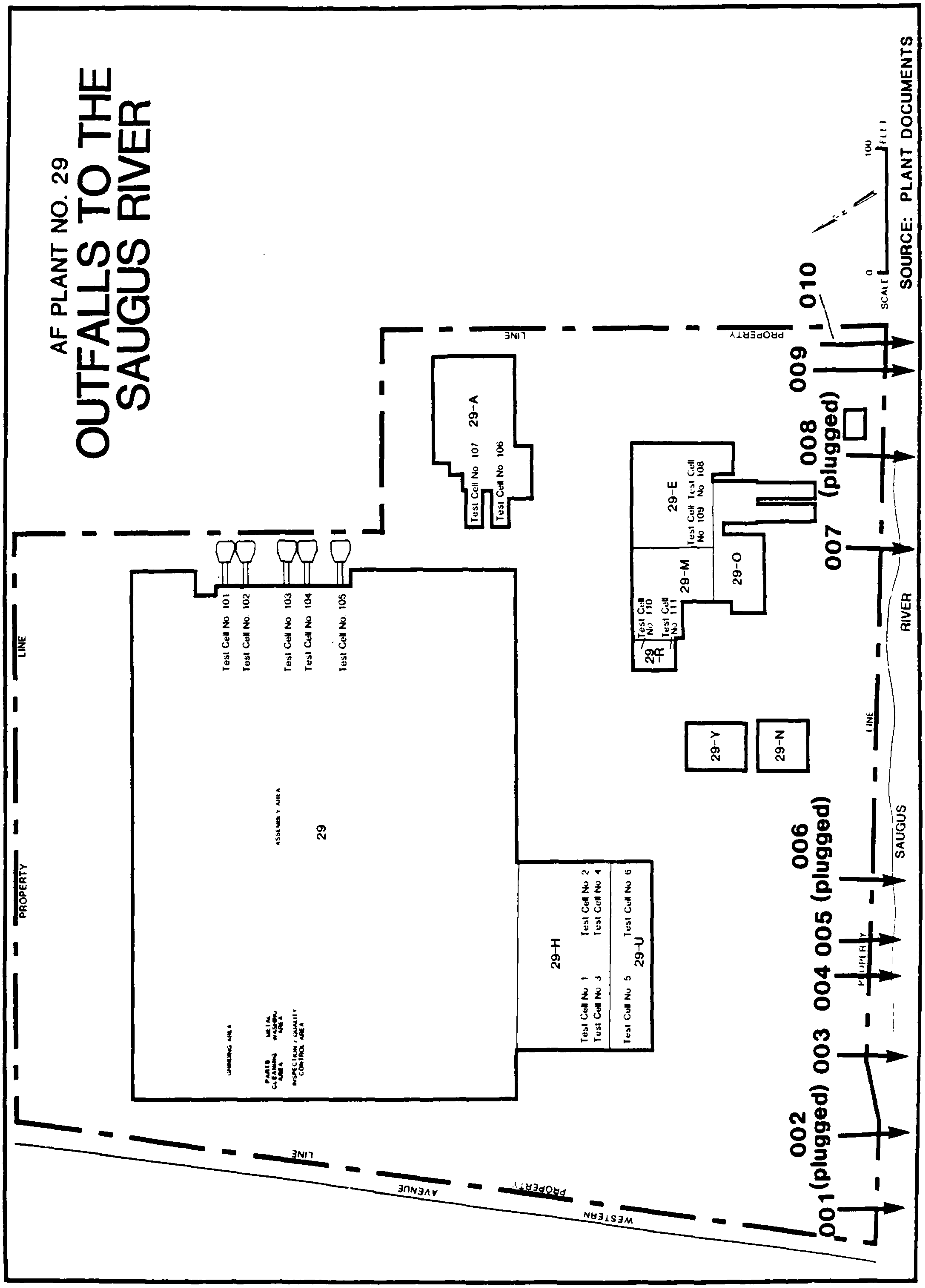
TABLE 4.11

OUTFALLS TO THE SAUGUS RIVER
AFP No. 29

Outfall No.	Type of Wastewater Conveyed	Source of Wastewater	Years of Service
001	Surface Drainage	Surface Runoff from the NW Corner of AFP No. 29 Property	1943 - Present
002	Oily·Wastewater	Wastewater from Test Cells 1, 3 and 5 in Buildings No. 29-U and 29-H - Flow Diverted to Building 29-N	1958 - 1977 (plugged)
003	Cooling Water	Non-Contact Cooling Water from Test Cell No. 5 in Building No. 29-U	1966 - Present
004	Rainwater	Roof Drain Runoff from Buildings No. 29-U, 29-H and 29 Property	1943 - Present
005	Cooling Water	Non-Contact Cooling Water from Dynamometer in Test Cell No. 4 in Building No. 29-H	1958 - Present
006	Oily Wastewater	Wastewater from Test Cells 2, 4 and 6 in Buildings 29-U and 29-H - Flow Diverted to Building 29-N	1958 - 1977 (plugged)
007	Surface Drainage	Surface Runoff in Area of Building 29-E (Once Conveyed Process Wastewater - Diverted to Building 29-N	1945 - Present
008	Oily Wastewater	Wastewater from Test Cells 108 and 109 in Building No. 29-3 - Flow Diverted to Building No. 29-N	1945 - 1977 (plugged)
009	Surface Water	Surface Runoff from Paved Area South of Building No. 29-E	1943 - Present
010	Cooling Water	Non-Contact Cooling Water from Building No. 29-A	1944 - Present
032	Surface Drainage	Surface Runoff from Bulk Fuel Farm	1950's - Present

SOURCE: Plant documents

FIGURE 4.8



AF PLANT NO. 29
OUTFALLS TO THE SAUGUS RIVER
Test Cell No 101
Test Cell No 102
Test Cell No 103
Test Cell No 104
Test Cell No 105
Test Cell No 106
Test Cell No 107
29-A
29-E
Test Cell No 108
Test Cell No 109
29-M
29-O
Test Cell No 110
Test Cell No 111
29-R
29-Y
29-N
29
ASSEMBLY AREA
29-H
Test Cell No 1
Test Cell No 2
Test Cell No 3
Test Cell No 4
29-U
Test Cell No 5
Test Cell No 6
PARTS CLEANING AREA
METAL WASHING AREA
INSPECTION / QUALITY CONTROL AREA
PROPERTY LINE
WESTERN AVENUE
SAUGUS RIVER
001
002 (plugged)
003
004
005
006 (plugged)
007
008 (plugged)
009
010
SCALE 0 100 FEET
SOURCE: PLANT DOCUMENTS

002, 006, 007 and 008, are piped into the gravity collection systems. The in-line OWS's that previously treated waste going to these outfalls were decommissioned.

The waste oil that is separated by the automated system is containerized and transported from the waste oil shed (Building 29-N) to the GE River Works ultrafiltration/centrifugation unit in Building 84 (off AFP No. 29 property) prior to burning for heat recovery. Oily sludge that accumulates in the collection system's 1,000-gallon holding tank is pumped out by an outside contractor for off-site disposal. This procedure is typically performed on a quarterly basis and an estimated 500 gallons of waste sludge is removed. The water fraction that is separated is discharged to the sanitary sewer system.

AFP No. 29 Sanitary Sewer System

Sanitary sewage from AFP No. 29 is piped to the Lynn City Sewer District's system. Prior to 1956, when the Group 29 Buildings were connected to the sanitary sewer system, all sanitary wastes were disposed of to septic leach fields located on plant property. Presently, no treatment of sanitary wastes occurs at the plant site.

AFP No. 29 Septic Leach Fields

From 1943 until 1956, septic leach fields located at the northwest side and southeast corner of the main manufacturing building were used for the disposal of sanitary wastes from the Group 29 Buildings. Both septic leach fields were removed from service in 1956-57 when the Group 29 Buildings were connected to the sanitary sewer system. Pipelines that connected the buildings to the leach fields were plugged and the system was abandoned.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

The review of past operation and maintenance functions and past waste management practices at Air Force Plants No. 28 and 29 has resulted in the identification of 15 and 9 sites, respectively, which were initially considered as areas of concern with regard to the potential for contamination, as well as the potential for the migration of contaminants. These sites were evaluated using the Decision Tree Methodology referred to in Figure 1.1. Those sites which were considered as not having a potential for contamination were eliminated from further

consideration. Those sites which were considered as having a potential for the occurrence of contamination and migration of contaminants were further evaluated using the Hazardous Assessment Rating Methodology (HARM). Table 4.12 identifies the decision tree logic used for each of the areas of initial concern.

Based on the decision tree logic, 4 of the 15 sites from AFP No. 28 and 3 of the 9 sites from AFP No. 29 that were originally reviewed were not considered to warrant evaluation using the Hazardous Assessment Rating Methodology. The rationale for omitting these sites from HARM evaluation is discussed below.

AFP No. 28

The underground fuel tanks are monitored for inventory control and the above ground tanks are checked on a routine basis. Other than the fuel tanks that were removed from service (identified in HARM), no information indicated that fuels are lost from the storage tanks.

There was no evidence or information indicating that spills have occurred at the hazardous waste storage area, process chemical storage area, oil house or PCB storage area. Therefore, there is no potential for contaminant migration at these sites.

The present chip storage bins drain to an oil/water separator. There is no potential or migration of contaminants from this site.

Chemical spills occasionally occur in the metal treatment area; however, these small spills are contained within the building and are cleaned-up by an off-site contractor. No potential for contaminant migration is associated with this site.

Neither the previous incinerator sites (i.e.; open fire pit, tepee incinerator and dual chamber incinerator) or the on-site areas that were used for the disposal of ash from these past refuse incineration activities are considered as potential contaminant migration sources. Plant refuse including paper, cardboard and wood were the only wastes that were incinerated.

The grit blast disposal area is not of significant environmental concern since only inert wastes were disposed of at this site. No potential for contamination migration exists.

Decommissioned PCB transformers and PCB waste oils are stored in a secured area in the main manufacturing building. There was no evidence

or information indicating that spills have occurred in this storage area. Therefore, there is no potential for contamination migration from this site.

AFP No. 29

The 20,000 gallon spill of JP-4 from a broken fuel supply line behind Building 29-E resulted in fuel being discharged to the surface drainage system. Several thousand gallons of fuel was recovered immediately following the incident and a small amount of fuel was recovered from the test wells which were placed in the vicinity of the spill. The test wells were pumped for several months during each of the two summers following the incident and no detectable amount of fuel was recovered as a result of these efforts.

The underground fuel tanks are routinely monitored for inventory control and the aboveground tanks and bulk fuel farm are visually inspected for leaks. With the exception of the tanks located at the southeast corner or the main assembly building which was found to leak and subsequently removed from service, no leakage of fuel from the tanks was known to have occurred. Therefore, there is little potential for contaminant migration from those sites.

The above ground fuel distribution system was pressure tested upon completion of construction in 1978. Also, the distribution system is visually checked for leaks on a regular basis. The inspections have not identified any leaks in the distribution system. Therefore, there is no site contamination associated with the distribution system.

The underground waste oil tanks are periodically checked for leaks. No leakage of waste oil from the tanks was known to have occurred.

No significant spills from the alkaline cleaning process line or the Zyglo fracture test line have been reported. The small spills that have occurred in this area in the past were diluted with water and discharged to the sewer system. Presently, spills that occur from the process lines are contained within spill containment dikes and are cleaned-up with vacuum trucks and transported off-site for treatment and disposal.

HARM Analysis

The remaining seven sites identified in Table 4.12 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes

TABLE 4.12
SUMMARY OF DECISION TREE LOGIC FOR AREAS OF INITIAL ENVIRONMENTAL CONCERN AT AIR FORCE PLANTS NO. 28 AND 29

	Potential for Contamination	Potential for Contaminant Migration	HARM Rating
AFP No. 28			
Waste Sump	Yes	Yes	Yes
Storage Tank Leaks (underground)	Yes	Yes	Yes
Fuel Tank Leaks (diked)	No	No	No
Hazardous Waste Storage Area	Yes	No	No
Process Chemical Storage	Yes	No	No
Oil House	No	No	No
PCB Storage Area	No	No	No
Waste Oil Tanks (underground)	Yes	Yes	Yes
Chips Storage Bins (present)	No	No	No
Chips Storage Area (past)	Yes	Yes	Yes
Metal Treatment Area	No	No	No
Open Fire Pit	No	No	No
Tepee Incinerator	No	No	No
Duel Chamber Incinerator	No	No	No
Grit Blast Disposal Site	No	No	No
AFP No. 29			
Fuel Tanks	Yes	No	No
Fuel Tanks (below ground)	Yes	Yes	Yes
Bulk Fuel Farm	Yes	No	No
Fuel Spills	No	No	No
Underground Fuel Distribution System	Yes	Yes	Yes
PCB Transformers	No	No	No
Waste Oil Tanks	Yes	No	No
Alkaline Cleaning Process Line	No	No	No
Zyglo Fracture Test Line	No	No	No

SOURCE: Plant documents

into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. The details of the rating procedures are presented in Appendix F. Results of the assessment for the sites are summarized in Table 4.13. The HARM system is designed to indicate the relative need for follow-on action. The information presented in Table 4.13 is intended for assigning priorities for further evaluation of the Air Force Plants No. 28 and 29 disposal areas (Chapter 5, Conclusions, and Chapter 6, Recommendations). The rating forms for the individual waste disposal sites at Air Force Plants No. 28 and 29 are presented in Appendix G. Photographs of some of the key disposal sites are included in Appendix E.

TABLE 4.13
SUMMARY OF HARM SCORES
FOR POTENTIAL CONTAMINANT SOURCES
AT AIR FORCE PLANTS NO. 28 AND 29

Rank Site	Air Force Plant No.	Receptor Subscore	Waste Characteristics Subscore	Pathway Subscore	Waste Management Factor	Total Score
Waste Sump	28	40	56	56	1.0	50
Chip Storage Area (Past)	28	40	48	61	1.0	50
Storage Tank Leak (Underground)	28	40	40	67	1.0	49
Waste Oil Tank Leak (Underground)	28	40	40	67	1.0	49
Fuel Line Leaks (Underground)	29	43	56	61	1.0	53
Fuel Storage Tank Leak (Underground)	29	40	64	48	1.0	51
Fuel Spill	29	40	48	61	0.1	5

SOURCE: Plant Documents

SECTION 5

CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on field inspections, review of records and files, review of the environmental setting, and interviews with plant personnel, past employees, and state government employees. Table 5.1 contains a list of the potential contamination sources identified at Air Force Plants No. 28 and 29 and a summary of the HARM scores for those sites. Information pertaining to these sites is summarized below and follow-on recommendations are presented in Chapter 6.

WASTE SUMP (AFP No. 28)

There is sufficient evidence that the waste sump has a potential for creating environmental contamination and follow-on investigations are warranted. The waste sump was used from 1941 to 1979 for the disposal of water-based coolants and coolants mixed with oil and light lubricating oils. Other waste liquids may also have been disposed of in the sump. Detailed records were not kept of the volumes of wastes that were disposed of at this site. The estimated volume of the underground sump is 9,000 gallons and the sump was rarely pumped out during its years of service. It is likely that contaminants leaked from the waste sump. The shallow aquifer is present near the surface. This site received a HARM score of 50.

PAST CHIP STORAGE AREA (AFP No. 28)

There is sufficient evidence to indicate that the chip storage area has a potential for creating environmental contamination and follow-on

TABLE 5.1
SITES EVALUATED USING THE HAZARDOUS ASSESSMENT
RATING METHODOLOGY
AIR FORCE PLANTS NOS. 28 AND 29

Rank	Site	Operating Period	Final HARM Score
AFP No. 28			
1	Waste Sump	1941 - 1979	50
2	Chip Storage Area (010)	1941 - 1973	50
3	Underground Tank Leak	1941 - 1979	49
4	Underground Waste Oil Tank Leak	1941 - 1980	49
AFP No. 29			
1	Underground Fuel Line Leaks	1943 - 1970's	53
2	Underground Fuel Storage Tank Leak	1943 - 1978	51
3	Fuel Spill	1983	5

investigation is recommended. From 1941 to 1973, metal chips were stored on the ground in the area adjacent to the current chip storage bin site. Some of the lubricating oils from the metal chips may have washed from the site in surface runoff; however, oil probably infiltrated into the soil ana the ground-water table near the surface. This site received a HARM rating of 50.

UNDERGROUND TANK LEAKS (AFP No. 28)

There is insufficient evidence to indicate that the underground storage and waste oil tanks that were found to leak in 1979 and 1980, respectively, have a potential for creating significant environmental contamination. The volume of hydraulic fluid and waste oil that leaked from the respective tanks was estimated to be small. Since the tanks are located on-site in the same general vicinity as the waste sump, the wells that are recommended for monitoring the waste sump would also serve as monitoring wells for the underground tanks. Therefore, the installation of additional wells is not needed. Both of the sites received HARM scores of 49.

UNDERGROUND FUEL TANK AND FUEL LINE LEAKAGE (AFP No. 29)

There is sufficient evidence that the leakage from the underground fuel tank and the underground fuel distribution lines have a potential for creating environmental contamination. The volume of fuel lost from these sources is unknown; however, the fuel tank and lines were in use from 1943 until the 1970's. As a result of a pressure testing program initiated in the 1970's, the fuel tank and many of the fuel lines were removed from service. Considering the plant site has a ground water at shallow depths, contaminant migration would be expected from these sites. These sites received a HARM score of 51 and 53, respectively.

FUEL SPILL (AFP No. 29)

There is insufficient evidence to indicate that the fuel spill which occurred in 1983 has a potential for creating environmental contamination and follow-on investigation is not recommended. The 2500 gallon spill occurred on a paved area outside the containment dikes at the bulk fuel farm. The spill was contained and cleaned up without

significant environmental contamination occurring. This site received a HARM score of 5.

SECTION 6

RECOMMENDATIONS

Seven sites were identified at Plants 28 and 29 as having the potential for environmental contamination. These sites have been evaluated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional Phase II, IRP investigation. Three of the sites have sufficient potential to create environmental contamination and Phase II recommendations are recommended. All sites have been reviewed with regard to land use restrictions which may be applied.

PHASE II MONITORING

The subsequent recommendations are made to further assess the potential for environmental contamination from waste disposal areas at Plants 28 and 29. The recommended actions are generally one-time sampling programs to determine if contamination does exist at the site. If contamination is identified, the sampling program should be expanded to define the extent of contamination. The recommended monitoring program, including analytical parameters, is summarized in Table 6.1. Figures 6.1 and 6.2 illustrate the proposed Phase II monitoring locations. The proposed sampling locations are based upon consideration of local soil and surface water conditions. Environmental sampling may consist of the following procedures:

1. Install ground-water quality monitoring wells into the uppermost aquifer at strategically selected locations.
2. Collect soil borings to the depth of the ground-water table at selected locations.
3. Obtain representative samples from the wells and soil borings and analyze for contamination indicator parameters.

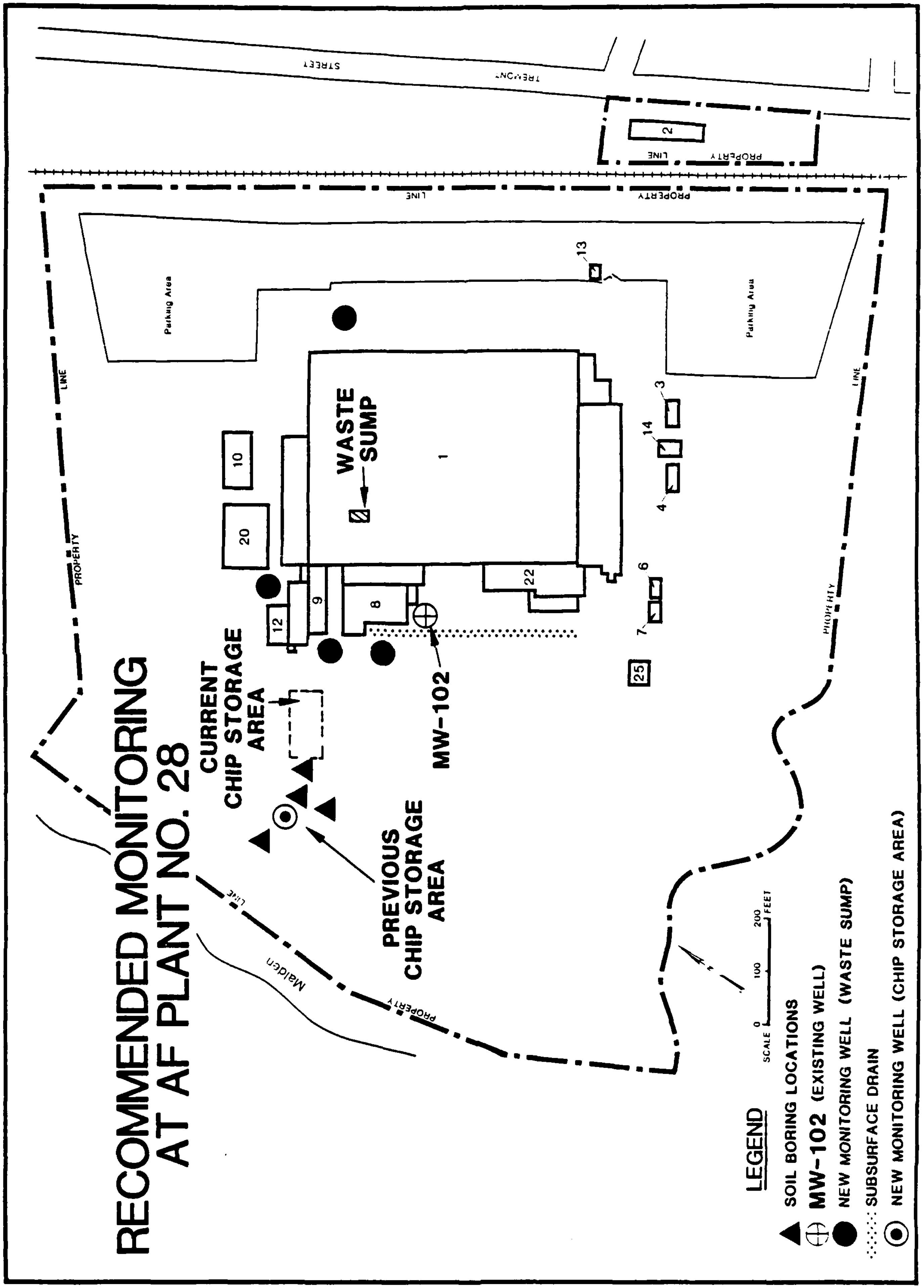
TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II
IRP AT AFP Nos. 28 AND 29

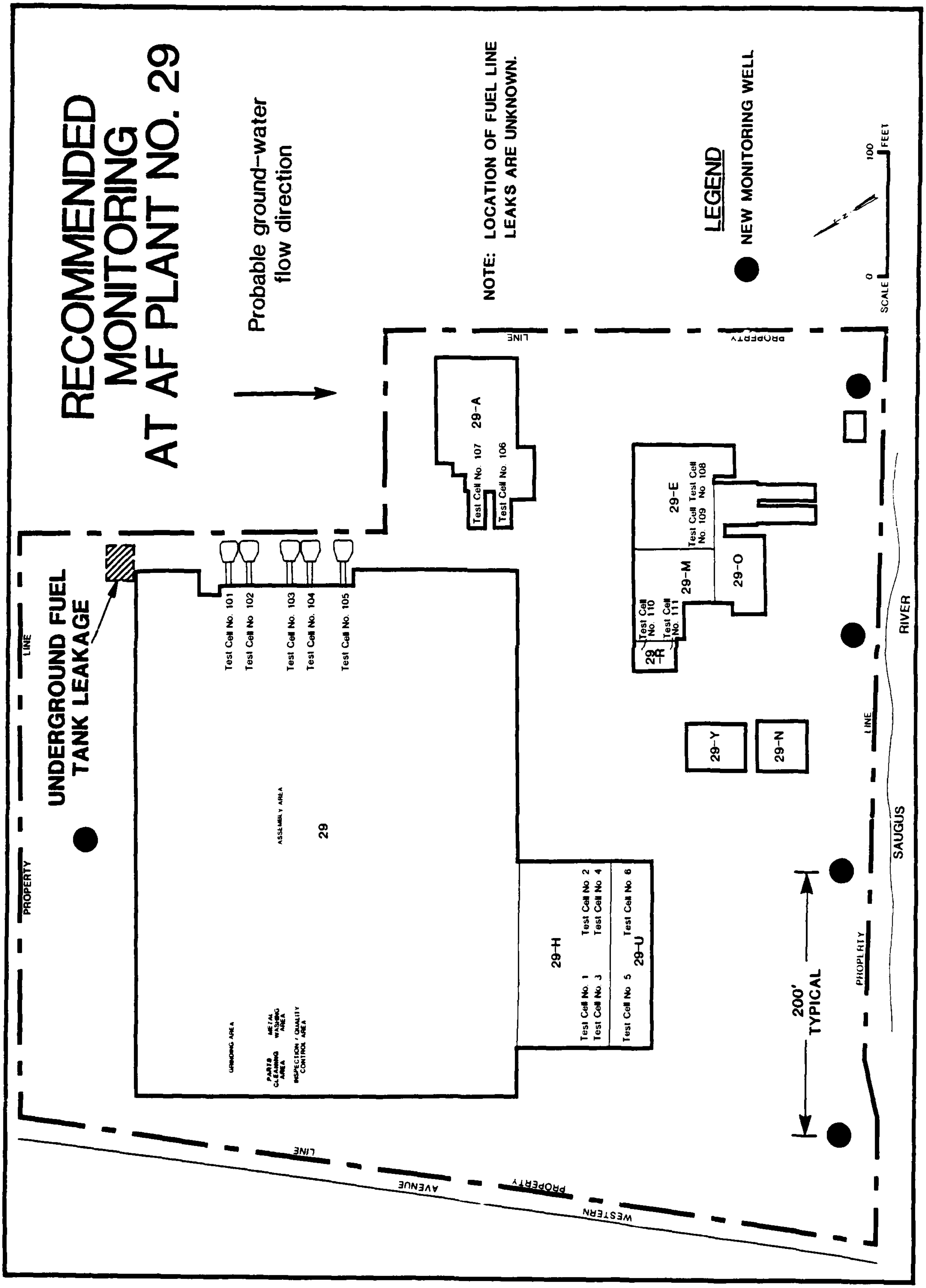
Area/Site (Rating Score)	Recommended Monitoring[1]	Recommended Analytical Parameter
AFP 28 Waste Sump (50)	Install monitoring wells at four locations. Continue using an existing well (MW-102). Collect and analyze samples.	Oil and grease Total organic carbon Total organic halogens Phenol Total dissolved solids
Chip Storage Area (50)	Collect soil borings from four locations and analyze.	Metals by ICPES[3] Oil and grease
	Install one monitoring well. Collect and analyze samples	Metals by ICPES[3] Oil and grease
AFP 29 Fuel Line Leaks (53)[2]	Install monitoring wells at five locations. Collect and analyze samples.	Oil and grease
AFP 29 Fuel Tank Leakage (51)[2]	Utilize program cited above. Monitor both sites together.	Same as above

1 See Figures 6.1 and 6.2 for recommended monitoring locations.

2 Consider two sites together as a single potential source.

3 ICPES - Induced Coupled Plasma Emissions Spectograph.


RECOMMENDED MONITORING
AT AF PLANT NO. 28
TREMONT STREET
PROPERTY LINE
Parking Area
Parking Area
WASTE SUMP
CURRENT CHIP STORAGE AREA
PREVIOUS CHIP STORAGE AREA
MW-102
Malden
1
2
3
4
6
7
8
9
10
12
13
14
20
22
25
SCALE 0 100 200 FEET
LEGEND
SOIL BORING LOCATIONS
MW-102 (EXISTING WELL)
NEW MONITORING WELL (WASTE SUMP)
SUBSURFACE DRAIN
NEW MONITORING WELL (CHIP STORAGE AREA)


RECOMMENDED MONITORING AT AF PLANT NO. 29
Probable ground-water flow direction
NOTE: LOCATION OF FUEL LINE LEAKS ARE UNKNOWN.
LEGEND
NEW MONITORING WELL
SCALE
0
100
FEET
UNDERGROUND FUEL TANK LEAKAGE
PROPERTY
LINE
29-A
Test Cell No. 107
Test Cell No. 106
29-E
Test Cell No 109
Test Cell No 108
29-M
29-O
Test Cell No. 110
Test Cell No. 111
29-R
29-Y
29-N
Test Cell No. 101
Test Cell No 102
Test Cell No. 103
Test Cell No. 104
Test Cell No. 105
ASSEMBLY AREA
29
GRINDING AREA
METAL WASHING AREA
PARTS CLEANING AREA
INSPECTION / QUALITY CONTROL AREA
29-H
Test Cell No 1
Test Cell No 2
Test Cell No 3
Test Cell No 4
29-U
Test Cell No 5
Test Cell No 6
200' TYPICAL
SAUGUS
RIVER
PROPERTY
LINE
WESTERN
AVENUE

Geophysical techniques have not been recommended for use at the plants for several reasons including the expected high chloride content in surficial soils and the proximity of some sites to area surface waters and to each other. Chloride-containing soils may tend to degrade the performance of geophysical instruments, while the proximity to other sites and the streams could make data interpretation questionable.

The recommended environmental monitoring programs for those sites receiving comparatively high HARM scores follows. It is noted that the environmental monitoring program recommended for some sites considers that two sites be monitored as a single unit. This action has been used in situations where a second contaminant plume may have merged into a pre-existing plume. In this situation, the two cannot be conveniently separated for the purposes of environmental monitoring.

RECOMMENDATIONS

AFP No. 28 Waste Sump Leakage

This storage facility was designed to retain liquid wastes until such time as they could be removed and transported to an appropriate disposal site. The sump was closed in 1979, but possible leakage is suspected. Although a recent study was conducted and did not detect contamination, it is probable that such work was not as extensive as necessary to perform a viable investigation. The site's environmental setting consists of fill overlying peat (marsh deposits) over coarse sands and gravel. Hard till, consisting of sandy clay underlies the shallow units. Water levels are shallow and ground-water flow is generally west to the Malden River. Because previous work conducted at Plant 28 appeared to focus on the marsh deposits (presumably as the contaminated medium), it is recommended that ground-water quality monitoring examine conditions in the sand and gravel shallow aquifer (refer to Figure 3.5, the log of Plant 28 boring no. 41).

Ground-water monitoring to detect contamination from the waste sump is recommended at the four approximate locations shown on Figure 6.1. One well is located hydraulically upgradient, and three wells are located downgradient. The actual locations of monitoring wells must be determined in the field, with respect to the sites and true shallow aquifer flow. Monitoring wells should be constructed of (minimum)

two-inch diameter PVC solid-wall casing, mechanically fitted to five-foot long machine-slotted screen. The well assembly will range in total length from ten to fifteen feet and must be adequately sealed into the uppermost aquifer in order to permit the acquisition of representative ground-water samples. In addition, the use of the existing monitoring well, MW-102, should be continued and its data incorporated into the overall Phase II monitoring program.

AFP No. 28 Chip Storage Area

The chip storage area, prior to 1973, was located in an area west of the present chip storage bins. The metal chips from the plant machining operations were piled on the ground resulting in lubricating oils draining onto the surface soils. No previous work has been conducted to determine the extent of contamination at this site.

The site's environmental setting is the same as was discussed in the previous section. The geological characteristic of the site consists of fill overlying peat over coarse sand and gravel. Sandy clay underlies the shallow units. The ground-water level is characteristically shallow and flows west toward the Malden River.

Soil and ground-water monitoring is recommended to determine the extent of the contamination resulting from past chip storage practices. The location for the collection of the soil samples and the placement of the monitoring well are depicted in Figure 6.1.

Four soil samples should be collected in the vicinity of the chip storage area. Two soil samples should be collected directly over the previous storage area. The other two samples should be collected down gradient and on the perimeter of the former storage site. The soil borings should be collected to the depth of the ground water level. The soil samples should be analyzed for the parameters listed in Table 6.1.

The ground-water monitoring well should be placed down gradient from the chip storage area. It is recommended that the monitoring well collect samples in the sand and gravel shallow aguifer (refer to Figure 3.5, the log of Plant 28, boring No. 41). The location of the well would be determined in the field, with respect to the site and true shallow aquifer flow direction. This monitoring well would comply with the specifications of the other wells being installed on-site. Specifically, the well would be constructed of two-inch diameter PVC

solid-wall casing, mechanically fitted to five-foot long machine-slotted screen. The well will be approximately ten to fifteen feet deep and must be adequately sealed into the uppermost aguifer in order to permit the acquisition of representative ground-water samples. The water samples should be analyzed for the parameters listed in Table 6.1.

AFP No. 29 Underground Fuel Tank and Fuel Line Leakage

Underground fuel storage tank and transmission line leakage is suspected at Plant 29. Although they were rated separately (as separate sources), they are environmentally inseparable due to site geology and contaminant type. Therefore, it is recommended that these two sources be treated as one. The site geology is principally fill over marine sands (silty sand and shells) over glacial clays, as shown on Figure 3.7. According to Figure 3.7, the upper aquifer is most likely the silty sand and shell layer. Ground water occurs at shallow depths. Fuel leakage can best be detected by installing monitoring wells into this unit at the locations shown on Figure 6.2. Ground-water monitoring is recommended at the five approximate locations shown on Figure 6.2. One well is located hydraulically upgradient, and four wells are located downgradient. It is presumed that the predominant flow direction in the shallow aquifer is toward the Saugus River. This may change locally due to tidal impacts. The actual locations of monitoring wells must be determined in the field, with respect to the sites and true shallow aquifer flow. Monitoring wells should be constructed of (minimum) two-inch diameter PVC solid-wall casing, mechanically fitted to twenty-foot long machine-slotted screen. The well assembly will range in total length from thirty to forty feet and must be adequately sealed into the uppermost aquifer in order to permit the acquisition of representative ground-water samples. All water samples should be analyzed for the parameters listed in Table 6.1.

TABLE OF CONTENTS

APPENDIX A

BIOGRAPHICAL DATA

E. J. Schroeder, P.E.
J. R. Absalon
S. R. Steele, Jr.

Biographical Data

ERNEST J. SCHROEDER

Environmental Engineer
Manager, Solid and Hazardous Waste

Personal Information

Date of Birth: 17 June 1944

Education

B.S. in Civil Engineering, 1966, University of Arkansas, Fayetteville, Arkansas
M.S. in Sanitary Engineering, 1967, University of Arkansas, Fayetteville, Arkansas

Professional Affiliations

Registered Professional Engineer (Arkansas No. 3259, Georgia No. 10618, Texas No. 33556 and Florida No. 0029175)
Water Pollution Control Federation
American Academy of Environmental Engineers

Honorary Affiliations

Chi Epsilon

Experience Record

1967-1976 Union Carbide Technical Center, Engineering Department, South Charleston, West Virginia (1967-1968). Project Engineer. Responsible for environmental protection engineering projects for various organic chemicals and plastics plants. Conducted industrial waste surveys, landfill design, and planning for plant environmental protection programs; evaluated air pollution discharges from new sources; reviewed a wastewater treatment plant design; and participated on a project team to design a new chemical unit.

Union Carbide Corporation, Environmental Protection Department, Texas City, Texas (1969-1975). Project Engineer and Engineering Supervisor. Responsible for various aspects of plant pollution abatement programs, including preparation of state and federal permits for wastewater treatment activities.

9/83

ERNEST J. SCHROEDER (Continued)

Operations Representative on $8 million regional wastewater treatment project and member of design team which made the initial site selection and process evaluation and recommendation. Participated in contract negotiations, process and detailed engineering design, construction of the facilities, preparation of start-up manuals, operator training, and the start-up activities. Designated as Project Engineer after start-up on expansion to original waste treatment unit.

Engineering Supervisor responsible for operation of wastewater treatment facilities including collection system, sampling and monitoring programs, spill control and clean-up, primary waste treatment, wastewater transfer system, biological waste treatment, and waste treatment pilot plants. Developed odor control program which successfully reduced odor emissions and represented Union Carbide at a public hearing on community odor problems.

Led special projects such as an excess loss control program to reduce water pollution losses; sewer segregation program involving coordination and reporting of 38 projects for the separation of contaminated and non-contaminated water; and sludge disposal program to develop long-term sludge disposal alternatives and recover land in present sludge landfill area. Developed improved methods of sampling and continuous monitoring of wastewater.

Union Carbide Corporation, Environmental Protection Project Engineer, Toronto, Ontario, Canada (1975-1976). Responsible for the overall environmental permitting, engineering design, construction and start-up of waste treatment systems associated with a new refinery.

1976-Date Engineering-Science, Inc., Project Manager (1976-1978). Responsible for several industrial wastewater projects including the following: wastewater investigation to characterize sources of waste streams in a chemical plant and to develop methods to reduce the wastes, sludge settling studies to evaluate settling characteristics of activated sludge at a chemical plant, development of a process document for the design and operation of a wastewater treatment facility at a petrochemical complex, wastewater treatment evaluation which included characterization of wastewater, unit process evaluation, inhibition studies, design review, operations review, preparation of operations manual, operator training and providing operating assistance for waste treatment facilities, various biological treatability studies and bench-scale and pilot-scale evaluation of advanced waste treatment

ERNEST J. SCHROEDER (Continued)

technologies such as granular carbon adsorption, multi-media filtration, powdered activated carbon treatment, ion exchange and ozonation.

Project Manager for hazardous waste disposal projects involving waste characterization, development of criteria for disposal of hazardous waste, site investigation, preparation of permits, detailed design, construction of facilities and spill clean-up activities.

Deputy Project Manager for industry-wide pilot plant study of advanced waste treatment in the textile industry. Technologies evaluated included coagulation/clarification, multi-media filtration, granular carbon adsorption, powdered activated carbon treatment, ozonation and dissolved air flotation.

Engineering-Science, Inc., Manager of the Industrial Waste Group in the Atlanta, Georgia office (1978-1980). Responsible for the supervision of industrial waste project managers and project engineers and the management of industrial waste studies conducted in the office. Also directly involved in project management consulting with clients on environmental studies and environment assessment projects, e.g., project manager for several spill control and wastewater treatability projects and for a third-party EIS for a new phosphate mine in Florida.

Engineering-Science, Inc., Manager of Solid and Hazardous Waste Group in the Atlanta, Georgia office (1980-date). Responsible for the supervision of solid and hazardous waste project managers and project engineers and the management of solid and hazardous waste projects in the office. Project activities have included permit and regulatory assistance, environmental audits, waste management program development, delisting partitions, ground-water monitoring, landfill evaluations, landfill closure design, hazardous waste management, waste inventory, waste recovery/recycle evaluation, waste disposalalternative evaluation, transportation evaluation, and spill control and countermeasure planning.

Project Manager for twelve Phase I Installation Restoration Program projects for the U.S. Air Force. The objective of this program is to audit past hazardous waste disposal practices that could result in migration of contaminants and recommend priority sites requiring further investigation. Also conducted environmental audits (air, water and solid

ERNEST J. SCHROEDER (Continued)

waste) at over ten industrial facilities. Project manager for a contamination assessment and hazardous waste site cleanup being conducted for an industrial client as part of a consent degree agreement. Project manager for site investigation and contamination assessment projects at multiply hazardous waste sites in the northeast.

Publications and Presentations

Schroeder, E. J., "Filamentous Activated Sludge Treatment of Nitrogen Deficient Waste," research paper submitted in partial fulfillment of the requirements for MSCE degree, 1967.

Schroeder, E. J. and Loven, A. W., "Activated Carbon Adsorption for Textile Wastewater Pollution Control," Symposium Proceedings: Textile Industry Technology, December 1978, Williamsburg, VA.

Schroeder, E. J., "Summary Report of the BATEA Guidelines (1974) Study for the Textile Industry," North Carolina Section of AWWA/ WPCA, Pinehurst, North Carolina, November 1979.

Mayfield, R. E., Sargent, T. N. and Schroeder, E. J., "Evaluation of BATEA Guidelines (1974) Textiles," U.S. EPA Report, Grant No. R-804329, February 1980.

Storey, W. A. and Schroeder, E. J., "Pilot Plant Evaluation of the 1974 BATEA Guidelines for the Textile Industry," Proceedings of the 35th Industrial Waste Conference, Purdue University, May 1980.

Pope, R. L., and Schroeder, E. J., "Treatment of Textile Wastewaters Using Activated Sludge With Powdered Activated Carbon," U.S. EPA Report, Grant No. R-804329, December 1980.

Schroeder, E. J., "Industrial Solid Waste Management Program to Comply with RCRA," Engineering Short Course Instructor, Auburn University, October 1980.

Schroeder, E. J., "Technical and Economic Impact of RCRA on Industrial Solid Waste Management, Florida Section, American Chemical Society, May 1981.

Schroeder, E. J. and Sargent, T. N., "Hazardous Waste Site Rating Systems," Textile Wastewater Treatment and Air Pollution Control Conference, January 1983.

Biographical Data

JOHN R. ABSALON
Hydrogeologist

Personal Information
Date of Birth: 12 May 1946

Education
B.S. in Geology, 1973, Upsala College, East Orange, New Jersey

Professional Affiliations
Certified Professional Geologist (Indiana No. 46)
Association of Engineering Geologists
Geological Society of America
National Water Well Association

Experience Record

1973-1974 Soil Testing Incorporated-Drilling Contractors, Seymour, Connecticut. Geologist. Responsible for the planning and supervision of subsurface investigations supporting geotechnical, ground-water contamination, and mineral exploitation studies in the New England area. Also managed the office staff, drillers, and the maintenance shop.

1974-1975 William F. Loftus and Associates, Englewood Cliffs, New Jersey. Engineering Geologist. Responsible for planning and management of geotechnical investigations in the northeastern U.S. and Illinois. Other duties included formal report preparation.

1975-1978 U.S. Army Environmental Hygiene Agency, Fort McPherson, Georgia. Geologist. Responsible for performance of solid waste disposal facility siting studies, non-complying waste disposal site assessments, and ground-water monitoring programs at military installations in the southeastern U.S., Texas, and Oklahoma. Also responsible for operation and management of the soil mechanics laboratory.

1978-1980 Law Engineering Testing Company, Atlanta, Georgia. Engineering Geologist/Hydrogeologist. Responsible for the project supervision of waste management, water quality assessment, geotechnical, and hydrogeologic studies at commercial, industrial, and government

10.22
John R. Absalon (Continued)

facilities. General experience included planning and management of several ground-water monitoring programs, development of remedial action programs, and formulation of waste disposal facility liner system design recommendations. Performed detailed ground-water quality investigations at an Air Force installation in Georgia, a paper mill in southwestern Georgia, and industrial facilities in Tennessee.

1980-Date Engineering-Science. Hydrogeologist. Responsible for supervising efforts in waste management, solid waste disposal, ground-water contamination assessment, leachate generation, and geotechnical and hydrogeologic investigations for clients in the industrial and governmental sectors. Performed geologic investigations at twenty Air Force bases and other industrial sites to evaluate the potential for migration of hazardous materials from past waste disposal practices. Conducted RCRA ground-water monitoring studies for industrial clients and evaluated remedial action alternatives for a county landfill in Florida. Conducted quality management, hydrogeologic and ground-water quality programs for the pulp and paper industry at several mills located in the Southeast United States.

Publications and Presentations

"An Investigation of the Brunswick Formation at Roseland, NJ," 1973, with others, The Bulletin, Vol 18, No. 1, NJ Academy of Science, Trenton, NJ.

"Engineering Geology of Fort Bliss, Texas," 1978, coauthor: R. Barksdale, in Terrain Analysis of Fort Bliss, Texas, US Army Topographic Laboratory, Fort Belvoir, VA.

"Geologic Aspects of Waste Disposal Site Evaluations," 1980, with others, Program and Abstracts AEG-ASCE Symposium on Hazardous Waste Disposal, April 26, Raleigh, NC.

"Practical Aspects of Ground-Water Monitoring at Existing Disposal Sites," 1980, coauthor: R.C. Starr, Proceedings of the EPA National Conference on Management of Uncontrolled Hazardous Sites, HMCRI, Silver Spring, MD.

"Improving the Reliability of Ground-Water Monitoring Systems," 1981, Proceedings of the Madison Conference of Applied Research and Practice on Municipal and Industrial Waste, University of Wisconsin-Extension, Madison, WI.

10.22
John R. Absalon (Continued)

Ground-Water Monitoring Workshop, 1982. Presented to Mississippi Bureau of Pollution Control, Jackson, 15-17 February.

Ground-Water Monitoring Workshop, 1982. Presented to Alabama Division of Solid and Hazardous Waste, Huntsville, 20-21 July.

Ground-Water Monitoring Workshop, 1982. Presented to Kentucky Waste Management Division, Bowling Green, 27-28 July.

"Identification and Treatment Alternatives Evaluation for Contaminated Ground Water," 1982, coauthor: M. R. Hockenbury. Presented to Association of Engineering Geologists Symposium on Hazardous Waste Disposal, Atlanta, 17 September.

"Preliminary Assessment of Past Waste Storage and Disposal Sites," 1982, coauthor: W. G. Christopher. Presented to Association of Engineering Geologists Symposium on Hazardous Waste Disposal, Atlanta, 17 September.

"Treatment Alternatives Evaluation for Aquifer Restoration," 1983, coauthor: M. R. Hockenbury, Proceedings of the Third National Symposium on Aquifer Restoration and Ground Water Monitoring, NWWA, Worthington, OH.

Biographical Data

S. ROBERT STEELE, II

Environmental Scientist

Personal Information

Date of Birth: 27 November 1955

Education

B.S. in Environmental Health, 1978, Old Dominion University
A.A.S. in Business Management, presently, Northern Virginia Community College

Experience Record

1978	Hampton Road Sanitation District, Industrial Waste Division, Virginia Beach, Virginia. Participated in compliance monitoring program and ongoing field investigations of industrial waste contributors. Performed routine analyses on industrial wastewater samples.
1978-1980	County of Fairfax, Lower Potomac Pollution Control Laboratory, Lorton, Virginia. Performed analytical testing on industrial waste and treatment plant (process control) wastewater samples. Participated in countywide monitoring programs on the streams, landfill monitoring wells, and industrial discharges.
1980-1983	County of Fairfax, Industrial Waste Section, Lorton, Virginia. Contributed to establishing Fairfax County's pretreatment program. Scheduled and conducted compliance monitoring of significant enforcement actions as a court-approved expert witness in pretreatment systems and industrial waste monitoring procedures.
1983-1984	Engineering-Science, Environmental Scientist. Participated in ongoing projects including an extensive wastewater characterization program at seven Metrobus garages of the Washington Metropolitan Area Transit Authority.

APPENDIX B

LIST OF INTERVIEWEES

APPENDIX B

TABLE B.1

LIST OF INTERVIEWEES - AIR FORCE PLANT 28

	Most Recent Position	Years of Service
1.	Manager of Maintenance Department	43
2.	Manager of Manufacturing Engineering	28
3.	Supervisor of Maintenance Department	5
4.	Manager of Plant Inventory Control	42
5.	Machine Repairman	43
6.	Equipment Analyst	18
7.	Supervisor of Computer Maintenance	17
8.	Pipe Fitter	5
9.	Welder 23	5
10.	Plumber Steam Fitter	5
11.	Environmental Control and Safety Engineer	6
12.	Supervisor of Finance and Rearrangement	35
13.	Crane Operator	36
14.	Maintenance Supervisor	6

APPFNDIX B

TABLF B.2

LIST OF INTERVIEWEES - AIR FORCE PLANT 29

	Most Recent Position	Years of Service
1.	Manager of Fnvironmental Services	4
2.	Environmental Control Engineer	14
3.	Manager of Plant Engineering	12
4.	Manager of Fnvironmental Control (Retired)	41
5.	Manager of Environmental Control	6
6.	Manager of Fnvironmental Systems	17
7.	Manager of Industrial Hygiene and Safety	24
8.	Maintenance Forman	32
9.	Plumber Steam Fitter	20
10.	Coordinator of Facility Plans and Programs	25
11.	Plumber Steam Fitter	10
12.	Fuel Piper	43
13.	Manager of Planning and Maintenance	35
14.	Planning and Maintenance - Analyst	25
15.	Engineer	40
16.	Maintenance Employee	39
17.	Operator	

APPENDIX B

TABLE B.3

LIST OF OUTSIDE AGFNCY CONTACTS

1. Thomas A. Peragallo, Soil Scientist, U.S. Department of Agriculture, Soil Conservation Service, 225 Great Road, P.O. Box 147, Littleton, MA 01460 - 617/486-3032

2. James Linney, Hydrogeologist, U.S. Geological Survey - Water Resources Division, 150 Causway Street, Suite 1309, Boston, MA 02114 - 617/223-6692

3. Barbara Getman, Publications Office, Geological Society of America, 3300 Penrose Plan, P.O. Box 9140, Boulder, CO 80301 - 303/447-2020

4. Ben Davis, Meteorological Specialist, U.S. Department of Commerce, National Climatic Data Center, Federal Building, Asheville, NC 28801 - 704/259-0682

5. Ida Babroudi, Environmental Engineer, Department of Environmental Quality Fngineering, Metropolitan Boston - Northeast Region, 323 New Boston Street, Woburn, MA 01801 617/935-2160

6. Deborah J. McKechnie, Principal Sanitary Engineer, Department of Environmental quality Engineering, Division of Water Pollution Control, Westview building, Lyman School, Westboro, MA 01581 - 617/366-9181

7. Ruth Leibman, Environmental Protection Specialist, Waste Management Division, Site Response Section, U.S. Environmental Protection Agency, Region I, Boston, MA 02203 - 617/223-1940

APPENDIX C

REFERENCES

APPENDIX C

REFERENCES

1. Dean, S. L., 1982. Engineering Problems Related to the Development of Ground-Water Supplies on Cape Cod, Mass., in Geotechnology in Massachusetts, O. C. Farquhar, editor. University of Massachusetts, Amherst, MA, pp. 47-53.

2. Delaney, D. F. and Gay, F. G., 1980a. Hydrology and Water Resources of the Coastal Drainage Basins of Northeastern Massachusetts from Castle Neck River, Ipswich, to Mystic River, Boston. U.S. Geological Survey Hydrologic Investigations Atlas HA-589.

3. Delaney, D. F. and Gay, F. B., 1980b. Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts. U.S. Geological Survey Open-File Report No. 80-1017.

4. Denny, Charles S., 1982. Geomorphology of New England. U.S. Geological Survey Professional Paper 1208.

5. Frimpter, M. H., 1982. Estimating High Ground-Water Levels from Observed Water Levels in Massachusetts, in Geotechnology in Massachusetts, O. C. Farquhar, editor. University of Massachusetts, Amherst, MA, page 73.

6. Hodges, Arthur L., 1969. Drilling for Water in New England. U.S. Geological Survey pamphlet.

7. Kaye, Clifford A., 1976. The Geology and Early History of the Boston Area of Massachusetts, A Bicentennial Approach. U.S. Geological Survey Bulletin 1476.

8. Kaye, Clifford A., 1978. Surficial Geologic Map of the Boston Area, Massachusetts. U. S. Geological Survey Open-File Report 78-111.

9. Kaye, Clifford A., 1982. Bedrock and Quaternary Geology of the Boston Area, Massachusetts, in Reviews in Engineering Geology, Volume V. Geology Under Cities, Robert F. Leggett, editor. Geological Society of America, Boulder, CO. pp. 25-40.

10. LaForge, Laurence, 1932. Geology of the Boston Area, Massachusetts. U.S. Geological Survey Bulletin 839.

11. National Oceanographic and Atmospheric Administration (NOAA), 1977. Climatic Atlas of the United States, Washington, DC.

12. National Oceanographic and Atmospheric Administration (NOAA), 1984. Miscellaneous Weather Data for Boston Area. National Climatic Data Center, Asheville, NC.

13. Perkins, Jordan, Inc., 1983. Hydrogeologic Investigation Relating to Abandoned Oil Sump, General Electric, Flight Propulsion Division, Everett, MA. Consultant's Report of Study to GE, dated October 10.

14. Sinnott, Allen, 1982. Summary Appraisals of the Nation's Ground-Water Resource - New England Region. U.S. Geological Survey Professional Paper 813-T.

15. U.S. Department of Agriculture, Soil Conservation Service, 1984 Soil Survey of Essex County, MA - Southern Part (Unpublished).

16. U. S. Geological Survey, 1967a. Engineering Geology of the Northeast Corridor, Washington, DC to Boston, MA: Bedrock Geology. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-514-A.

17. U. S. Geological Survey, 1967a. Engineering Geology of the Northeast Corridor, Washington, DC to Boston, MA: Coastal Plain and Surficial Deposits. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-514-B.

APPENDIX D

MASTER LIST OF INDUSTRIAL SHOPS

TABLE D.1
MASTER LIST OF INDUSTRIAL SHOPS
AIR FORCE PLANT NO. 28

Shop Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Present Waste Management
(?)	20	Yes	Yes	Waste Oil Tank
Blueprint	1	Yes	No	NA
Boiler Room	1	Yes	No	NA
Breeze Room	1	Yes	No	NA
Cordax Inspection	1	No	No	NA
Computer Room	1	No	No	NA
Dispensary Room	1	Yes	No	NA
Furnace Room	1	Yes	No	NA
Garage	1	Yes	Yes	Waste Oil Tank
Grinding Room	1	Yes	Yes	Waste Oil Tank
Heat Treat	1	Yes	Yes	Waste Oil Tank
Laboratory	1	Yes	Yes	Off-Site Contractor
Oil House	1	Yes	Yes	Waste Oil Tank
Plasma Spray	1	No	No	NA
Punch Press	1	Yes	Yes	Off-Site Contractor
Maintenance Department	1	Yes	Yes	NA
QC Inspection	1	No	No	NA
Raw Stock	1	No	No	NA
Receiving	1	Yes	No	NA
Receiving	27	Yes	No	NA
Ring Roll	1	Yes	Yes	Waste Oil Tank
Shipping	1	Yes	Yes	Off-Site Contractor
Standards Room	1	No	No	NA
Standards Room	27	No	No	NA
Tool and Die	1	Yes	Yes	Off-Site Contractor
Tool Control	1	No	No	NA
X-Ray	1	Yes	Yes	Silver Recovery

TABLE D.2
MASTER LIST OF INDUSTRIAL SHOPS
AIR FORCE PLANT NO. 29

Shop Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Present Waste Management
Air Compressor Station	29A	Yes	Yes	Waste Oil Tank
Assemble (Development)	29	Yes	Yes	Waste Oil Tank
Assemble F404	29	Yes	No	NA
Assemble J85 Rotor	29	Yes	No	NA
Assemble T58/T64/T700	29	Yes	No	NA
Assemble T700	29	Yes	No	NA
Cage (J85 Assemble Disp.)	29	No	No	NA
Test Cell No. 1	29	Yes	Yes	Oil Sewer (29N)
Test Cell No. 2	29	Yes	Yes	Oil Sewer (29N)
Test Cell No. 3	29	Yes	Yes	Oil Sewer (29N)
Test Cell No. 4	29	Yes	Yes	Oil Sewer (29N)
Test Cell No. 5	29	Yes	Yes	Oil Sewer (29N)
Test Cell No. 6	29	Yes	Yes	Oil Sewer (29N)
Test Cell No. 106	29A	Yes	Yes	Waste Oil Tank
Test Cell No. 107	29A	Yes	Yes	Waste Oil Tank
Test Cell No. 109	29E	Yes	Yes	Waste Oil Tank
Test Cell No. 110	29R	Yes	Yes	Waste Oil Tank
Test Cell No. 111	29R	Yes	Yes	Waste Oil Tank
Component Evaluation/TF34	29	Yes	No	NA
Development Assemble	29	Yes	Yes	Waste Oil Tank

TABLE D.2 (Continued)
MASTER LIST OF INDUSTRIAL SHOPS
AIR FORCE PLANT NO. 29

Shop Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Present Waste Management
Development Eng. Eval. Operations	29	No	No	NA
Development Hardware/T700	29	No	No	NA
Development Inspection	29	No	No	NA
Engine Demonstrator	29	No	No	NA
Engine Quality	29	Yes	Yes	Waste Oil Tank
Engineering/Dev. Eval./F404	29	No	No	NA
Engineering/Dev. Eval./J85	29	No	No	NA
Engineering/ Factory Eval.	29	No	No	NA
Evaluation/ All Engines	29	No	No	NA
Evaluation/F404	29	No	No	NA
Eval. Engr./ T58/T64/J85	29	No	No	NA
Field and Flight Eval.	29	No	No	NA
Finished Parts Pool	29	No	No	NA
Inspection	29	No	No	NA
Parts Pool Development	29	No	No	NA
Quality Assurance	29	No	No	NA
Shipping	29	No	No	NA
Test Mechanics	29A	Yes	Yes	Off-Site Contractor
Test (Production	29	Yes	Yes	Waste Oil Tank
Tool Crib	29	No	No	NA

TABLE D.2 (Continued)
MASTER LIST OF INDUSTRIAL SHOPS
AIR FORCE PLANT NO. 29

Shop Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Present Waste Management
Vapor Degreaser	29	Yes	Yes	Off-Site Contractor
Alkaline Cleaner	29	Yes	Yes	Neutralized to Sanitary Sewer
Grinding	29	Yes	Yes	Waste Oil Recovery
Fuel Storage	Tank Farm	Yes	Yes	Off-Site Contractor

APPENDIX E

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX E

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AF: Air Force.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent.

Ag: Chemical symbol for silver.

Al: Chemical symbol for aluminum.

ALKALINE CLEANER: Concentrated phosphate-free soap solution.

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

ARTESIAN: Ground water contained under hydrostatic pressure.

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

AVGAS: Aviation Gasoline.

Ba: Chemical symbol for barium.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.

$CaCO_3$: Chemical symbol for calcium carbonate.

Cd: Chemical symbol for cadmium.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CHIPS: Term used to define recyclable metal turnings or shavings.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CN: Chemical symbol for cyanide.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

COOLANT: An oil-water mixture used for cooling metal parts during forming.

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

DOD: Department of Defense.

DRUMLIN: A low, smoothly rounded, elongated oval hill, mound or ridge of compact glacial till or, less commonly, other kinds of drift (sandy till, varved clay) built under the margin of the ice and shaped by its flow, or carved out of an older moraine by readvancing ice; its longer axis is parallel to the direction of movement of the ice. It usually has a blunt nose pointing in the direction from which the ice approached and a gentler slope tapering in the other direction.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

FAA: Federal Aviation Administration.
FACILITY: Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FPTA: Fire Protection Training Area.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown organic compounds.

GE: General Electric Company.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HWMF: Hazardous Waste Management Facility.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of

contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INDURATION: The process by which relatively consolidated rock is made harder or more compact by heat, pressure or the introduction of cementing material.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

JP-4: Jet Propulsion Fuel Number Four, military jet fuel.

KOLENE SALTS: (Virgo 500 Salt) - Strongly alkaline molten salt used in descaling process. Manufactured by Kolene Corporation.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LIQUID CHEMICAL MILL WASTE: Strong acid solution.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone.

MGD: Million gallons per day.

MDC: Metropolitan District Commission

Mn: Chemical symbol for manganese.

MAGNA DRAW 40: Semi-synthetic water soluble lubricant used in the undiluted state for ring roll operations.

MONITORING WELL: A well used to measure ground-water levels and to obtain samples.

MORAINE: An accumulation of glacial drift deposited chiefly by direct glacial action and possessing initial constructional form independent of the floor beneath it.

MSL: Mean Sea Level.

NDI: Non-destructive inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration

NPDES: National Pollutant Discharge Elimination System.

OEHL: Occupational and Environmental Health Laboratory.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

O&G: Symbols for oil and grease.

OWS: Oil Water Separator

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

pH: Negative logarithm of hydrogen ion concentration.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.
POTENTIOMETRIC SURFACE: The imaginery surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

PPB: Parts per billion by weight.

PPM: Parts per million by weight.

PRECIPITATION: Rainfall.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RING ROLL: Cold metal working process used to form a variety of circular shapes with intricate cross sections.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SLUDGE: Any garbage, refuse, or slude from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal

Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

SUMP SUCKERS: Portable tanks used to transport waste, oil and coolants.

TCE: Trichloroethylene.

TDS: Total Dissolved Solids, a water quality parameter.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal.

TURCO LINE: Cleaning facility which has historically used Turco Corporation products including phosphoric acid, alkaline cleaners and potassium permanganate solutions for the removal of oils, oxides and surface soils.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground water.
USAF: United States Air Force.

USDA: United States Department of Agriculture.

USEPA: Unites States Environmental Protection Agency.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

VARSOL: Also called mineral or petroleum spirits. A volatile, clear, non-fluorescent liquid. Properties include boiling point 40-80°C; flash point less than 0°F; lower explosion limit 1.1%; upper explosion limit 5.9%; density .65-.66; auto ignition limit 550°F; and vapor density of 2.5.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Zn: Chemical symbol for zinc.

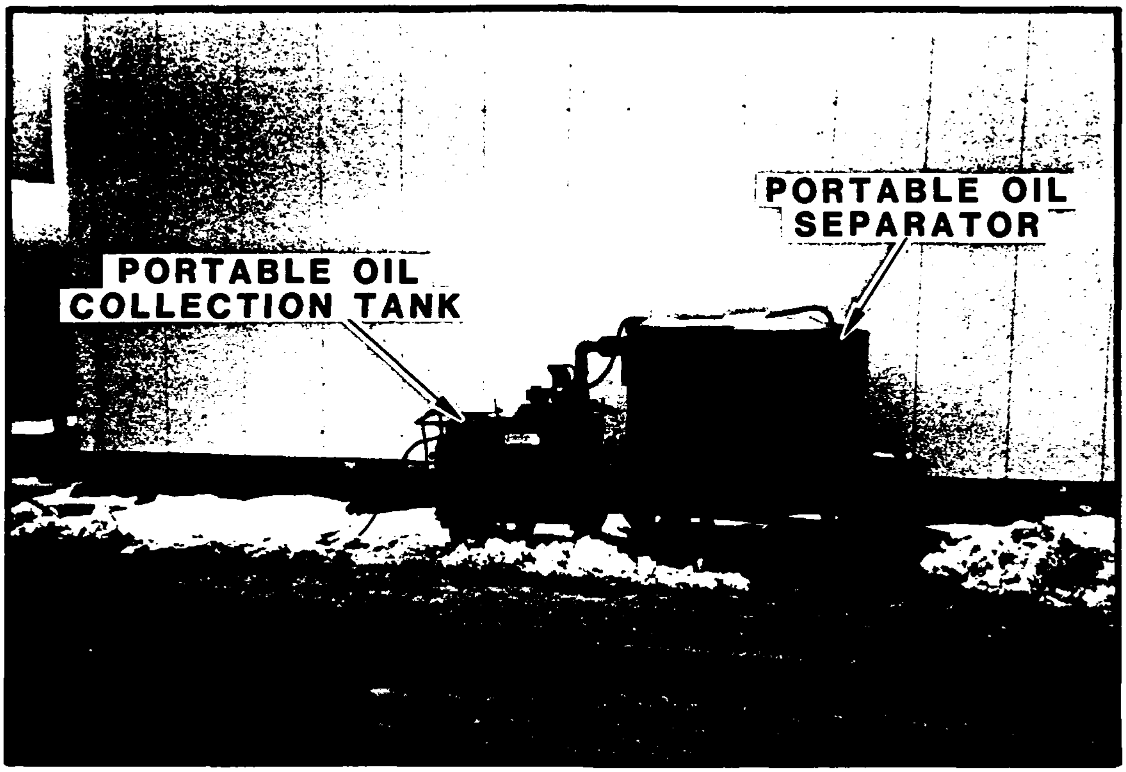
ZYGLO: A non-destructive testing procedure used to determine the existence of surface fractures or cracks under ultraviolet illumination.

APPENDIX F

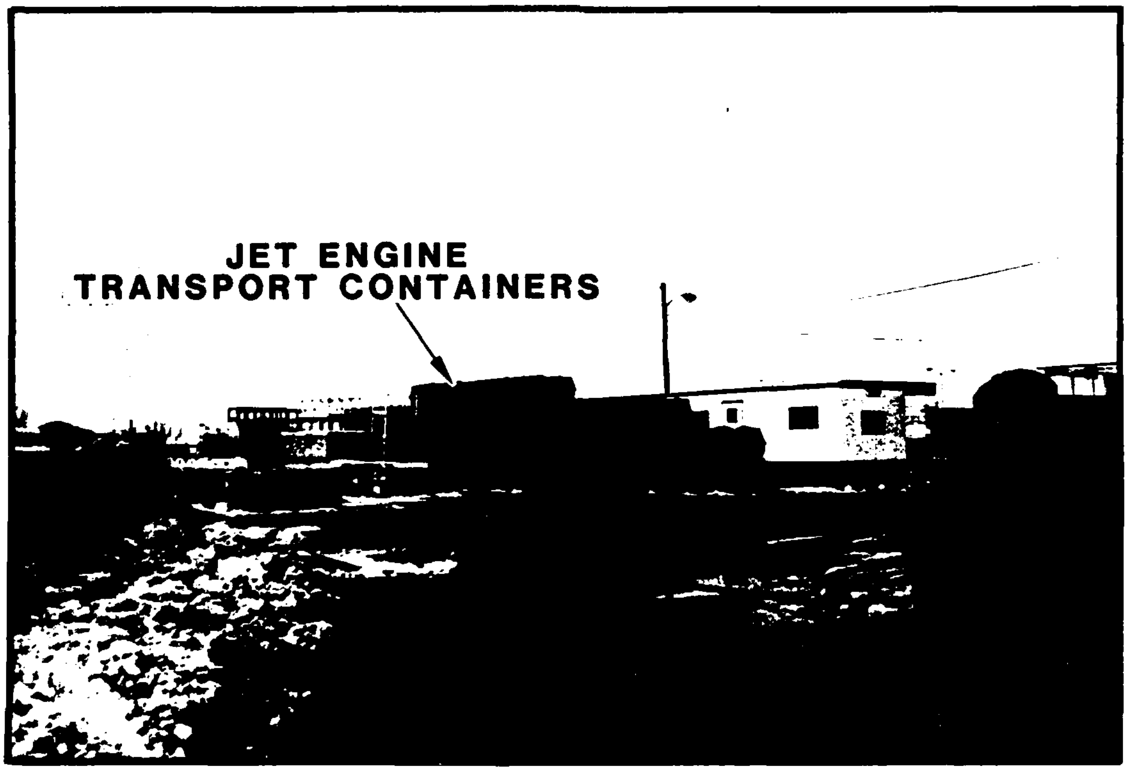
PHOTOGRAPHS

AF PLANT NO. 28

AF PLANT NO. 29

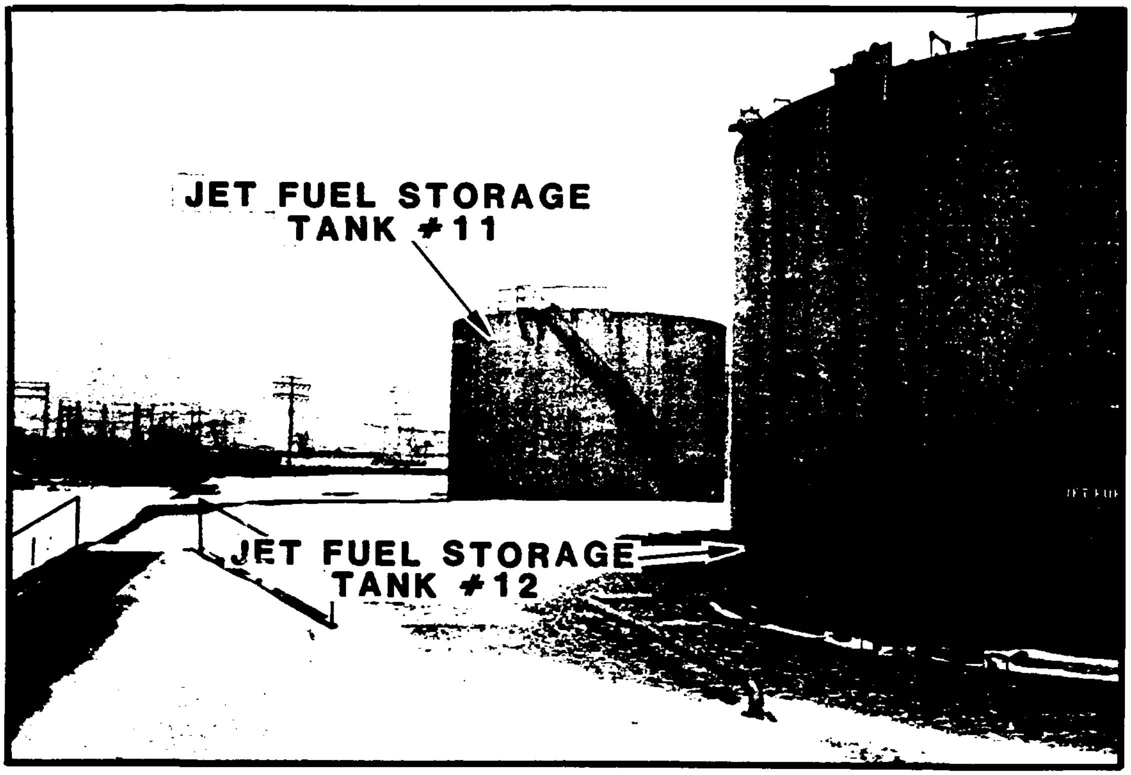


View of Well #C1 Adjacent to Building 29E

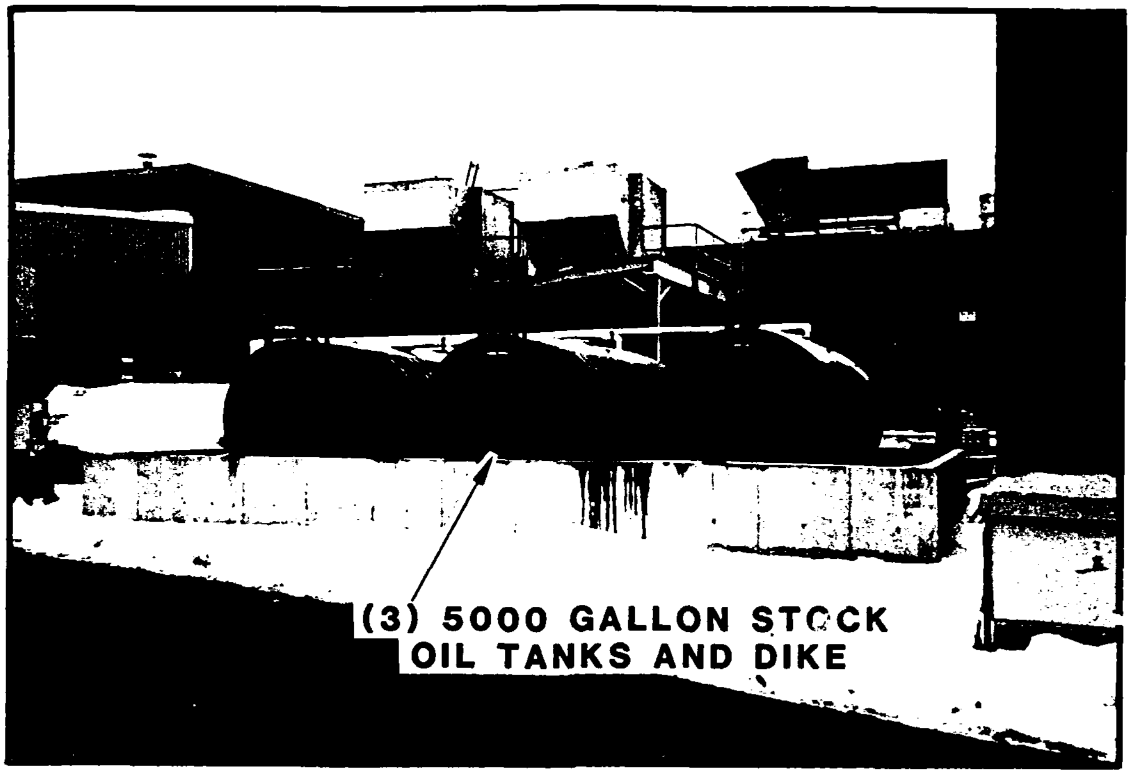


View Looking Northwest

AF PLANT NO. 29



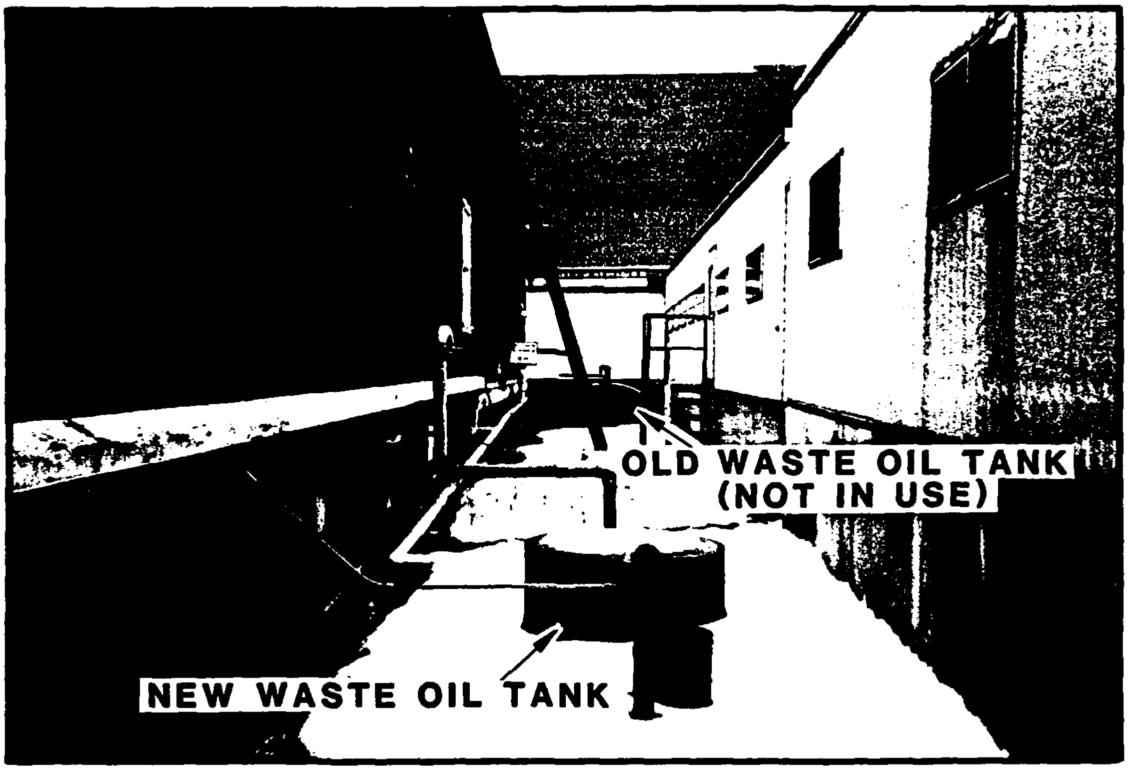
View Looking South



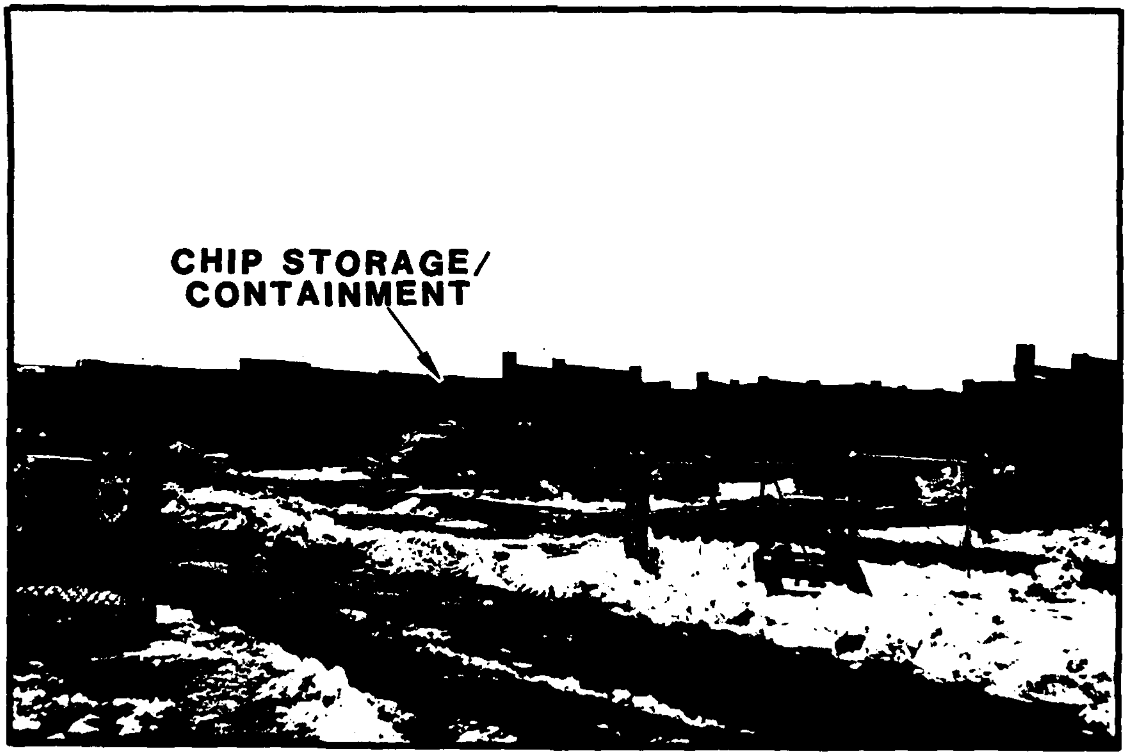
View Looking South

Hazardous Waste Storage Area and Shed

AF PLANT NO. 28



View Looking East



View Looking West

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

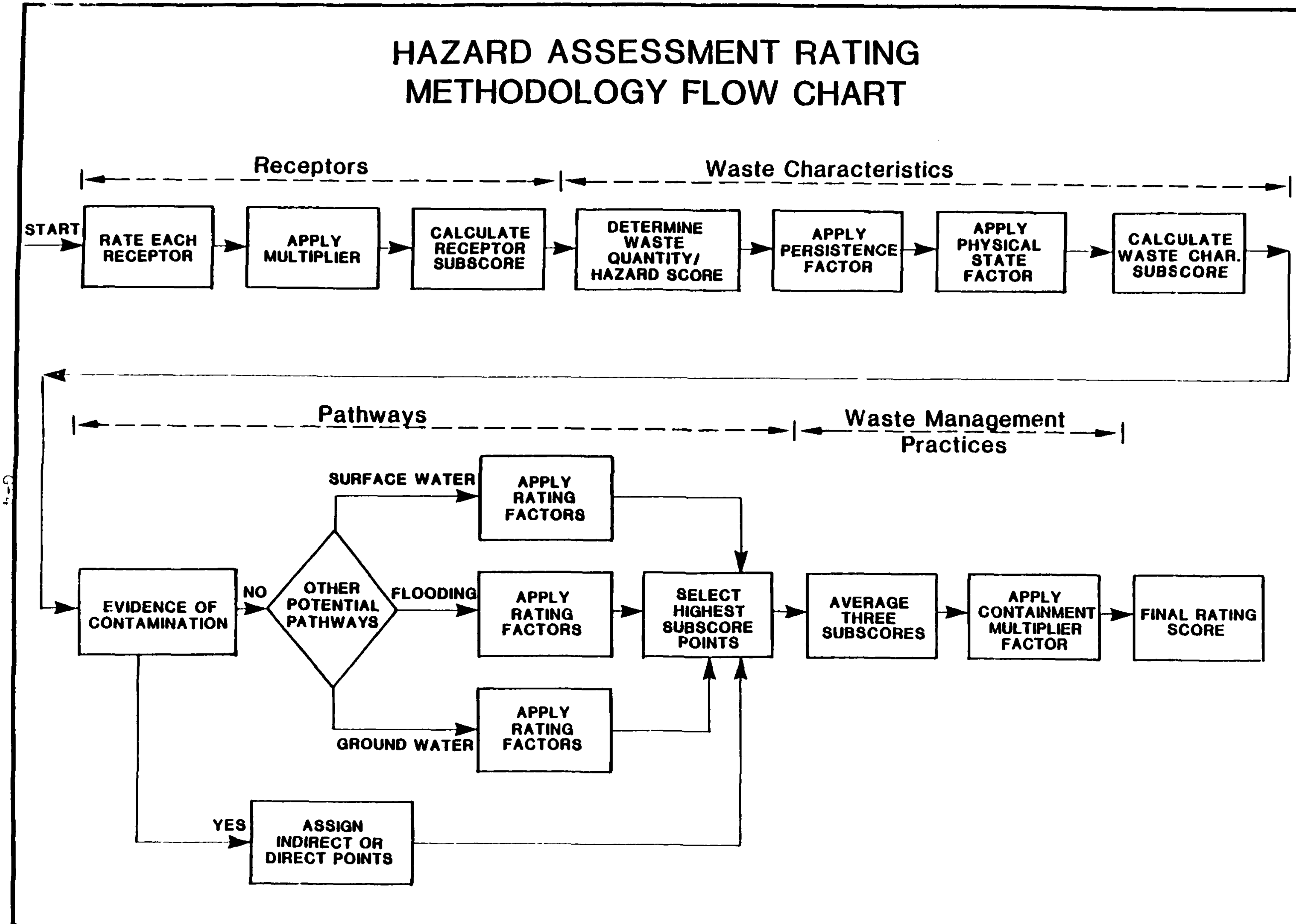
As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.



HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
Pathways
Waste Management Practices
EVIDENCE OF CONTAMINATION
NO
OTHER POTENTIAL PATHWAYS
SURFACE WATER
FLOODING
GROUND WATER
APPLY RATING FACTORS
APPLY RATING FACTORS
APPLY RATING FACTORS
SELECT HIGHEST SUBSCORE POINTS
AVERAGE THREE SUBSCORES
APPLY CONTAINMENT MULTIPLIER FACTOR
FINAL RATING SCORE
YES
ASSIGN INDIRECT OR DIRECT POINTS

FIGURE 1

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______________________

LOCATION ______________________

DATE OF OPERATION OR OCCURRENCE ______________________

OWNER/OPERATOR ______________________

COMMENTS/DESCRIPTION ______________________

SITE RATED BY ______________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		

Subtotals ______ ______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		3		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of *economically important* natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major *wetlands*.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:

For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level

- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating

- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year flood-plain	In 10-year flood-plain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, [illegible]..)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

HAZARD ASSESSMENT RATING METHODOLOGY FORMS

APPENDIX H

INDEX FOR HAZARD ASSESSMENT
METHODOLOGY FORMS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Waste Sump
Location: AFP 28, Under the floor in Bldg. 1 (adjacent to Ring Roll area)
Date of Operation or Occurrence: 1941 through 1975
Owner/Operator: USAF/General Electric
Comments/Description: Waste storage sump

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 3
2. Confidence level (1=confirmed, 2=suspected) 2
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

70 x 0.80 = 56

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

56 x 1.00 = 56

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	2	8	16	24
Subtotals			64	114
Subscore (100 x factor score subtotal/maximum score subtotal)				56

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		40
Waste Characteristics		56
Pathways		61
Total	157 divided by 3 =	52 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

52 x 1.00 = 52

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Underground Fuel line leaks
Location: AFP 29, Various locations around test cells
Date of Operation or Occurrence: 1950's - 1970's
Owner/Operator: USAF/General Electric
Comments/Description: Volume unknown - Fuel lines removed from service

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	2	6	12	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			78	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 43

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 3
2. Confidence level (1=confirmed, 2=suspected) 2
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

70 x 0.80 = 56

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

56 x 1.00 = 56

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	43
Waste Characteristics	56
Pathways	61
Total	160 divided by 3 = 53 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

53 x 1.00 = 53

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Underground Fuel Storage Tank Leak
Location: AFP 29, SE corner of building No 29
Date of Operation or Occurrence: 1970's
Owner/Operator: USAF/General Electric
Comments/Description: Volume unknown

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 2
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.00 = 64

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			52	114
Subscore (100 x factor score subtotal/maximum score subtotal)				46

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		40
Waste Characteristics		64
Pathways		48
Total	152 divided by 3 =	51 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

51 x 1.00 = 51

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Chip Storage Area
Location: AFP 28, West of the oil house, Bldg 9
Date of Operation or Occurrence: 1941 through 1975
Owner/Operator: USAF/General Electric
Comments/Description:

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assic maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			52	114
Subscore (100 x factor score subtotal/maximum score subtotal)				46

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		40
Waste Characteristics		48
Pathways		61
Total	149 divided by 3 =	50 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Underground Fuel Tank Leak
Location: AFP 28, Adjacent to Bldg. No.12
Date of Operation or Occurrence: 1982
Owner/Operator: USAF/General Electric
Comments/Description: Est. 1000 gal.

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 0.80 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	2	8	16	24
Subtotals			76	114
Subscore (100 x factor score subtotal/maximum score subtotal)				67

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		40
Waste Characteristics		40
Pathways		67
Total	147 divided by 3 =	49 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

49 x 1.00 = 49
FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Underground Waste oil Tank Leak
Location: AFP 28, North of Oil House, between bldgs. 8 and 9
Date of Operation or Occurrence: 1960
Owner/Operator: USAF/General Electric
Comments/Description: Volume Unknown

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 0.80 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	2	8	16	24
Subtotals			76	114
Subscore (100 x factor score subtotal/maximum score subtotal)				67

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		40	
Waste Characteristics		40	
Pathways		67	
Total	147	divided by 3 =	49 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

49 x 1.00 = 49
FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fuel Spill (JP-4)
Location: AFP 29,s Tank Farm
Date of Operation or Occurrence: 1983
Owner/Operator: USAF/General Electric
Comments/Description: 2500 gallons, contained and cleaned up

Site Rated by: Bob Steele, John Absalon, Ernie Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			52	114
Subscore (100 x factor score subtotal/maximum score subtotal)				46

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		40
Waste Characteristics		48
Pathways		61
Total	149 divided by 3 =	50 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

50 x 0.10 = 5

FINAL SCORE